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No. 1

SOIL TYPES AND GROWTH OF ALGÆ IN BAÑGOS FISHPONDS

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In the Philippines the commonest edible fish is the bañgos (*Chanos chanos* Forskål). The cultivation of this fish in ponds has been developed extensively, especially around Manila Bay.

Bañgos are essentially vegetarians. Their food consists principally of various species of algæ, known locally as lumut. When the supply of lumut is abundant the fish thrive and grow rapidly. Although hydrophytic in character these plants get part of their subsistence and anchorage from the soil.

This paper gives the results of a preliminary investigation to determine the types of soil found in some bañgos ponds and to ascertain their relation to the growth of the algæ.

HORIZONS OF FISHPOND SOILS

Soils that have water as the principal gross component were designated by Veatch as hydrosols. He classified such soils into four major morphologic horizons; namely, aqueous, subaqueous, and basal horizons in addition to the subbasal geologic substratum.

The hydrosols of the bañgos ponds around Manila Bay belong, in general, to the lacustrine group of shallow saline aqueous horizons. The depth of the aqueous horizon ranges from 20 centimeters in Cavite Province to 110 centimeters in Pampanga.

Aqueous horizon.—The first major horizon consists of the surface water, which is the "A₀" horizon of the normal soil

profile. Its importance lies in the fundamental requirements of many aquatic plants, which live almost entirely in a medium of water. Salinity, hardness, solids in suspension, and depth of the water are the most important factors in this zone.

Subaqueous horizon.—The second major horizon, the mud portion, is the "A" horizon in the normal soil profile. This is the anchorage place for most of the aquatic plants and a source of their nutrients. The physical properties and chemical composition of the soil in this zone naturally affect the growth of the plants.

Basal horizon.—The third major horizon is the "B" horizon in the normal soil profile. This is not as important as the subaqueous horizon. However, when the first and second horizons are shallow, its importance becomes quite significant.

Subbasal geologic substratum.—This is the "C" horizon in the normal soil profile. The character of the basal horizon is more or less dependent upon the geologic formation of this subbasal horizon.

SOIL TYPES OF SUBAQUEOUS HORIZONS

Field observations and the collection of soil samples of subaqueous horizons were made in four provinces bordering on Manila Bay; namely, Bataan, Pampanga, Rizal, and Cavite. All the samples were obtained from representative bangos ponds by means of a post-hole digger. The growth of algae, where the samples were taken, was carefully noted.

There were 6 samples collected from Bataan, 11 from Pampanga, 4 from Bulacan, 8 from Rizal, and 4 from Cavite, making a total of 33 soil samples. The number and location of the samples are recorded in Table 1. The description and relative growth of algae are given in Table 2.

Soil samples of the subaqueous horizons of the different fishponds were classified according to definite soil types as follows:

Type 1.—Peaty clay either compact or matted in structure. Samples 11, 16, 17, 18, and 25.

Type 2.—Peaty clay either soft or fluid in consistency. Sample 23.

Type 3.—Slimy clay, slightly organic and gelatinous in consistency. Samples 9, 13, 14, 19, 21, and 33.

Type 4.—Clay-colloid, largely inorganic, containing either dark-colored, grayish green, or reddish mud. Samples 10, 15, 26, 27, 36, and 40.

TABLE I.—Location of soil samples of the subaqueous horizon.

Sample No.	Place.	Feet No.	Remarks.
1	Silencio, Bulacan, Bulacan	1	
3	do	2	
4	do	1	
6	do	2	
7	do	2	
8	Puerto Hiver, Bulacan, Bulacan		Near the sea.
9	Guagua, Pampanga	1	
10	do	1	
11	Seamoon, Pampanga	2	
13	Botia, Pampanga	1	
14	do	1	
15	do	1	
16	Hacienda San Esteban, Marabhe, Pampanga	10	
17	do	16	
18	do	14	
19	do	3	
21	do		Lot 1-A.
23	Hacienda Sapang Cauayan, Sagay, Bulacan		Lot 3-A.
25	do		Lot 4-A.
26	do		Lot 2-A.
27	Hambang, Bulacan, Bulacan	1	
29	Calocan, Rizal	4	
30	do	2	
31	do	5	
32	Longos, Malabon, Rizal	1	
33	Paraiso, Rizal	1	
34	do	1	
35	Las Pitas, Rizal	1	
36	do	1	
37	Bacoor, Cavite	1	
38	Dalichica, Noveleta, Cavite		By the sea.
40	do		Do.
42	do		Beachside.

Type 5.—Fine sandy mud, sand-organic matter admixed. Samples 4, 6, 7, 32, 35, 38, and 42.

Type 6.—Sandy mud, sand-shell admixed. Samples 1, 3, 8, 29, 30, 31, and 37.

Type 7.—Sand, clean sand compact. Sample 34.

There is a wide range of texture and consistency in the subaqueous horizons of the different fishponds around Manila Bay. Fishponds in Pampanga and Bulacan Provinces, along Pampanga and Guagua Rivers, have subaqueous horizons of fine texture consisting mostly of clay with decayed trunks, leaves, and roots of the nipa palm. This is particularly true of the ponds at the Hacienda San Esteban of the Ayala Company and the Hacienda Sapang Cauayan of the La Tondeña Company, which are in a nipa-palm region.

TABLE 2.—*Descriptions of samples of briny-pond soils and the growth of the algae where the samples were collected.*

Sample No.	Depth of surface horizon.	Depth of subsurface horizon.	Description of subsurface horizon.	Description of topsoil horizon.	Growth of algae.
	cm.	cm.			
1	4-50	50-88	Brown and nearly black; very fine sandy mud, largely inorganic.	Dark gray sand.	Few.
U	0-50	50-88	Very dark brown; very fine sandy mud, largely inorganic.	Dark gray muddy sand.	Do.
4	0-50	50-88	Black; very fine sandy peat, mud; with few remains of alga palm.	Dark muddy sand.	Abundant.
6	0-50	50-102	Very dark gray; very fine sandy mud; largely inorganic.	Black sand.	No.
7	0-50	52-122	Dark gray; very fine sandy mud; largely inorganic.	Dark gray muddy sand.	Do.
8	0-48	48-84	Dark brown to black; peaty mud with partially decomposed alga palm; largely inorganic.	Dark brown sandy mud.	Few.
9	0-64	64-102	Black; muddy clay; largely inorganic with marine shells.	Very dark brown to black clay soil.	Very abundant.
10	0-48	48-74	Very dark brown to black muddy silty clay with marine shells.	Dark brown muddy clay.	Abundant.
11	0-40	40-80	Dark brown to nearly black; peaty mud and muddy clay; partially decomposed alga palm.	Dark gray silty clay mud.	Very abundant.
12	0-88	88-80	Gray to dark gray silty muddy clay.	Dark gray muddy clay.	Do.
14	0-44	44-84	Black with gray muddy clay; largely inorganic.	Gray muddy clay.	Do.
15	0-70	70-104	Dark brown to dark gray muddy clay soil; largely inorganic.	Dark gray muddy clay.	Abundant.
16	0-120	120-156	Dark gray peaty mud; mostly of decomposed alga palm.	Reddish brown peaty mud; largely of alga leaves.	Very abundant.
17	0-96	96-132	Reddish brown peaty and muddy clay loam with decomposed alga palm.	Reddish brown peaty muddy clay.	Do.
18	0-102	102-180	Dark brown to reddish brown peaty mud with marine shells and decayed roots and leaves of alga palm.	Reddish brown peaty mud; largely decayed roots and leaves.	No.
19	0-60	60-102	Dark silty and muddy clay largely organic with marine shells compact.	Dark gray silty mud with decayed leaves and roots of alga palm.	Do.
21	0-70	70-90	Black and gray silty muddy clay; largely organic with marine shells compact.	Reddish brown peaty mud largely organic; decayed roots and leaves.	No.
23	0-68	68-102	Black peaty mud; largely of decayed remains of alga palm.	Mixture of gray and reddish brown peat mud with decayed remains of alga palm.	Abundant.
25	0-70	70-90	Reddish brown silty muddy clay with decayed remains of alga palm.	Reddish brown peaty mud largely of decayed alga-palm remains.	Very abundant.
26	0-40	40-56	Black silty mud with plenty of marine shells.	Brown mud largely inorganic.	Abundant.

27	0-25	25-57	Very dark brown and black muddy clay, largely inorganic.....	Dark brown clay largely inorganic.....	Do.
28	0-55	55-100	Very dark brown to black; very fine sandy mud with marine shells	Brown sandy mud with few marine shells.....	Few.
30	0-50	50-92	Dark gray to black; very fine sandy mud, largely inorganic with marine shells.	Dark brown clay mud.....	Do.
31	0-42	42-98	Dark gray very fine sandy mud with marine shells.....	Dark brown muddy sand.....	Do.
32	0-48	48-76	Dark gray to dark green sandy mud; compact.....	Gray muddy sand.....	Do.
33	0-42	42-104	Black silty muddy clay; largely inorganic; compact.....	Dark brown sandy mud.....	Very abundant.
34	0-36	36-60	Dark gray muddy sand with marine shells.....	Dark brown sand with marine shells.....	Very low.
35	0-48	48-71	Very dark gray mud; largely inorganic.....	Dark brown muddy sand.....	Few.
36	0-35	35-72	Very dark gray to nearly black silty muddy clay.....	Gray muddy clay.....	Abundant.
37	0-46	46-85	Black silty sandy mud; largely inorganic.....	Dark brown muddy sand.....	Few.
38	0-40	40-118	Very dark gray to nearly black; very fine silty sandy muddy clay loam; compact.	Dark gray mud.....	Abundant.
40	0-40	40-94	Black; very fine silty muddy clay; largely inorganic.....	Dark gray peaty mud.....	Do.
43	0-20	20-32	Black silty sandy mud; compact.....	Dark gray to black sand.....	Do.

TABLE 3.—Average mechanical analyses of different types of subaqueous horizon and the growth of algae.

Type of subaqueous horizon	Coarse sand, 0.25 to 0.25 mm.	Medium sand, 0.25 to 0.14 mm.	Fine sand, 0.14 to 0.07 mm.	Very fine sand, 0.07 to 0.005 mm.	Silt, 0.005 to 0.0005 mm.	Clay, 0.0005 mm.	Solution loss, %	Growth of algae
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	
1	0.7	7.1	4.4	7.1	17.4	68.0	20.4	Very abundant.
2	0.0	0.1	0.2	10.0	50.0	39.0	23.2	Abundant.
3	2.3	0.6	0.1	11.4	20.0	65.0	16.6	Very abundant.
4	0.11	4.0	4.5	7.7	20.0	47.0	11.0	Abundant.
5	23.0	0.0	8.0	14.7	12.2	23.1	4.7	Do.
6	10.0	7.0	7.1	22.0	12.0	20.1	0.0	Few.
7	22.0	23.5	18.0	8.1	0.1	0.0	0.2	Very low.

* The solution loss is obtained by treating the sample with hydrogen peroxide and washing.

TABLE 3.—Average chemical analyses of different types of subaqueous horizon and the growth of alga.

Type of subaqueous horizon.	Nitrogen (N).	Phosphoric anhydride (P ₂ O ₅).	Potash (K ₂ O).	Organic matter.*	Growth of alga.
	Per cent.	Per cent.	Per cent.	Per cent.	
1	0.346	0.136	0.345	24.48	Very abundant.
2	0.213	0.176	0.612	15.56	Abundant.
3	0.363	0.107	0.836	16.11	Very abundant.
4	0.285	0.117	0.760	12.88	Abundant.
5	0.119	0.086	0.564	9.30	Ida.
6	0.098	0.107	0.767	7.78	Few.
7	0.051	0.107	0.739	5.75	Very few.

* Organic matter was obtained by the loss on ignition.

Bataan, Rizal, and Cavite Provinces have fishponds located near the sea with subaqueous horizons of varying texture depending upon the distance of the pond from the seashore and the type of soil in the immediate vicinity.

The subaqueous horizons of fishponds in Balanga, Bataan Province, consist mostly of fine sandy mud. In Malabon and Caloocan, Rizal Province, they are composed chiefly of fine sand. In Paranaque and Las Piñas, Rizal, they are a sandy mud that is black to dark gray in color; and in Bacoar and Noveleta, Cavite, they are also sandy mud.

EXPERIMENTAL PROCEDURE

Mechanical and chemical analyses were made of the individual soil samples included in each soil type. The analytical results of the samples included in each type were then averaged in order to get the mean results for each particular type.

Average mechanical analyses of the different types of subaqueous horizons are given in Table 3, and in Table 4 are given the average chemical analyses. Included in these tables are also notes on the growth of algae corresponding to various types of subaqueous horizons.

The mechanical analyses were made in accordance with the method of Olmstead, Alexander, and Middleton. The methods of the Association of Official Agricultural Chemists were used for the chemical analyses. The elements determined were nitrogen, phosphorus, and potassium. Organic matter was ascertained by the loss on ignition.

SUMMARY

A preliminary investigation of the soils of some fishponds bordering on Manila Bay was carried out.

Data from the mechanical and chemical analyses (Tables 3 and 4) indicate that, in general, algae seem to grow very abundantly in types of subaqueous horizons that have a high-solution loss and a high content of clay, nitrogen, and organic matter. Types that are deficient in these characteristics generally have very few algae.

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DIATOMS FROM KIZAKI LAKE, HONSHU ISLAND NIPPON

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SIXTEEN PLATES

In presenting this list of the diatoms that I found in Kizaki Lake, Shinano Province, Honshu Island, Nippon, I wish to offer some general results of the investigation.

The diatom material was collected in July, 1927, by Mr. K. Kiuchi, and sent to me through the kindness of Prof. Dr. T. Kawamura, director of the Zoölogical Institute, College of Science, Kyoto Imperial University. The material consisted of a glass tube with mud from the lake. The crude material was first examined under the microscope, by the use of magnifying powers ranging from 100 to 600 diameters, and only a few diatoms were discovered. When the mud was prepared for accurate investigation I found thousands of siliceous algae. The material was boiled in commercial hydrochloric acid for one-half hour. The acid when cold was decanted, and the residue washed with water to get rid of the resultant salts. After a few days the material was boiled in concentrated commercial sulphuric acid for one-half hour, after which powdered potassium chlorate was slowly added to the boiling acid until the black color gave place to yellow. A week was spent in removing the traces of acids and salts from the material. The prepared diatoms were preserved in alcohol. The diatom material was mounted in coumarone-piperin and mercuric iodide (HgI_2), proposed by Dr. R. W. Kolbe. I have examined a hundred microscopic slides with apochromat 2 mm E. Leitz, Wetzlar, and compensating oculars 6, 8, and 12. Half a year was spent in the study of this collection.

The diatom flora of Kizaki Lake is rich. The slides examined yielded 338 forms, a list of which is given below. Diatoms, especially those living in fresh water, are known to be very cosmopolitan in their habitats. Nevertheless, there are certain species characteristic of alpine and Arctic regions, and others

of warm climates. The diatom flora of Kizaki Lake is largely represented by various species of *Melosira* and *Cyclotella* and, especially, naviculoid forms, which are abundant in colder waters. Northern, Arctic, and alpine species predominate, tropical elements are richly represented. The alpine and Arctic diatoms are the following:

<i>Melosira distans</i> .	<i>Diploneis marginestrata</i> .
<i>Melosira italica</i> var. <i>vahla</i> .	<i>Navicula Rolanorum</i> .
<i>Cyclotella glomerata</i> .	<i>Pinnularia leptanema</i> .
<i>Distoma hiemale</i> .	<i>Cymbella naviculiformis</i> .
<i>Euxotia praeurula</i> .	<i>Cymbella aequalis</i> .
<i>Euxocoeleis flexella</i> .	<i>Cymbella heteroplicata</i> var. <i>minor</i> .
<i>Achnanthes lunecolata</i> var.	<i>Cymbella gracilis</i> .
<i>elliptica</i> .	<i>Cymbella alpina</i> .
<i>Frustulia rhomboides</i> .	<i>Gomphonema quadripunctatum</i> .
<i>Neidium bisulcatum</i> .	<i>Rhopalodia parallelia</i> .
<i>Neidium Kozlowi</i> .	

It is interesting to note that *Neidium Kozlowi* is reported from central Asia and *Gomphonema quadripunctatum* from Laikal Lake, northern Europe, and Mongolia.

To tropical elements must be referred the following species

<i>Melosira americana</i> .	<i>Amphora delphinea</i> .
<i>Melosira undulata</i> var. <i>Nor-</i>	<i>Cymbella turgidula</i> .
<i>manni</i> .	<i>Cymbella turgida</i> .
<i>Actinella brasiliensis</i> .	<i>Gomphonema gracile</i> .
<i>Euxotia tropica</i> .	<i>Gomphonema Berggrenii</i> .
<i>Neidium oblique-striatum</i> var.	<i>Epithemia cistula</i> var. <i>butaria</i> .
<i>Navicula confervacea</i> .	<i>Surirella Terryana</i> .

Such diatoms as *Melosira americana*, *Neidium oblique-striatum*, and *Surirella Terryana* occur in South America. A peculiar diatom, *Actinella brasiliensis*, is still living in Nippon, occurs in Demerara River in Guiana, South America, and is known as a fossil in the southern part of France. *Gomphonema Berggrenii* was described from New Zealand; *Epithemia cistula* is living in India and southern China, and is reported as a fossil in Hungary.

The brackish-water species from Kizaki waters are represented by the following:

<i>Fragilaria construens</i> var. <i>sub-</i>	<i>Navicula protracta</i> .
<i>aelina</i> .	<i>Navicula holoptida</i> forma <i>minor</i> .
<i>Achnanthes Hawckiana</i> .	<i>Navicula salinarum</i> var.
<i>Rhizosolenia curvata</i> .	<i>Pinnularia viridis</i> var. <i>leptogangyia</i> .
<i>Diploneis Smithii</i> var.	

Large new forms of *Diploneis Smithii* found in Kizaki Lake seem to belong to alpine species. The type of *Diploneis Smithii*

is known from brackish waters. Two fossil diatoms were discovered in Kizaki Lake. These are *Pinnularia lignitica*, originally reported from Nippon lignite, and *Cymbella sinuata* var. *antiqua* from Hungary.

The endemic diatoms in Kizaki Lake are represented by the following species.

<i>Veratoneis arcus</i> var. <i>Hattori</i>	<i>Pinnularia matycephala</i> var. <i>Hattori</i>
<i>Synedra japonica</i>	<i>Pinnularia montana</i> var.
<i>Achnanthes pinnata</i> var. <i>japonica</i>	<i>Cymbella japonica</i>
<i>Navicula subdiscipha</i>	<i>Gomphonema vastum</i>
<i>Navicula globulifera</i>	<i>Gomphonema linguatum</i>
<i>Pinnularia divergens</i> var. <i>japonica</i>	<i>Nitzschia interrupta</i>
<i>Pinnularia lignitica</i>	<i>Surirella robusta</i> forma <i>lata</i>
	<i>Surirella Caproni</i> var. <i>obtus</i>
	<i>Surirella Pan'oscokii</i>

All these diatoms were described by Reichelt, Meister, Hustedt, and Olve. The present list contains the names of 24 new diatoms, and they are also endemic to this country. This note is illustrated with drawings by the author, which will be of use in future investigations.

MELOSIRA VARIANS C. A. Ag. Plate 3, fig. 32.

Melosira varians C. A. Ag., Fr. HUSTEDT, Bacillar. (1930) 86, fig. 41.

Frustules 0.015 mm in breadth. Not common in Kizaki Lake. Known from Nippon.

MELOSIRA GRANULATA (Ehr.) Ralfs. Plate 1, fig. 4.

Melosira granulata (Ehr.) Ralfs, Fr. HUSTEDT, Bacillar. (1930) 87, fig. 44.

Frustules 0.01 mm in breadth. Rare. Known from Aokiko Lake.

MELOSIRA DISTANS (Ehr.) Kütz. Plate 1, fig. 10.

Melosira distans (Ehr.) Kütz., Fr. HUSTEDT, Bacillar. (1930) 92-93, fig. 53.

Frustules 0.005 to 0.007 mm in breadth with fine puncta 15 in 0.01 mm. Common in Kizaki and Aokiko Lakes. Known from alpine waters.

MELOSIRA DISTANS (Ehr.) Kütz. var. *LIRATA* (Ehr.) Bethge. Plate 10, fig. 12.

Melosira distans (Ehr.) Kütz. var. *lirata* (Ehr.) Bethge, Fr. HUSTEDT, Bacillar. (1930) 93, fig. 55.

A variety with more robust frustules 0.006 to 0.007 mm in breadth. Size 10 to 0.01 mm. Rather common in Kizaki.

Lake. The variety *africana* O. Mull., found by Fr. Husted in Aokiko Lake, was not seen in Kizaki Lake.

MELOSIRA AMERICANA Kütz. Plate 1, fig. 1.

Melosira americana KÜTZING, Bacillar (1865) 55, pl. 30, fig. 69. Fr. HUSTEDT, Bacillar u. d. Aokikosee in Japan (56, pl. 5, fig. 8).

Frustules cylindrical, barrel-shaped, 0.012 to 0.015 mm in diameter, with spinous junctions. This species is fairly abundant in Kizaki Lake. *Melosira americana* was described by Kutzing from tropical America in 1865 and found by Fr. Husted in Aokiko Lake in Nippon.

MELOSIRA BINDERANA Kütz. Plate 1, figs. 2 and 4; Plate 10, fig. 6.

Melosira Binderana KÜTZ., Fr. HUSTEDT, Bacillar. (1930) 86-87 fig. 43

A distinct species with small, slightly siliceous frustules breadth, 0.004 to 0.005 mm. Common in Kizaki Lake. Known from Europe and Asia.

MELOSIRA UNDULATA (Ehr.) Kütz. var. *NORMANNI* Arnott. Plate 1, fig. 2.

Melosira undulata (Ehr.) Kütz. var. *Normanni* Arnott, VAN HEURCK Synopsis pl. 90, fig. 7.

A very robust species with frustules 0.027 to 0.03 mm in breadth. This tropical diatom is known from Aokiko Lake in Nippon, southern China, and Java, and is a fossil in Europe.

MELOSIRA ITALICA (Ehr.) Kütz. var. *TENUSSIMA* (Grun.) O. Mull. Plate 1, fig. 5.

Melosira italica (Ehr.) Kütz. var. *tenuissima* (Grun.) O. Mull. VAN HEURCK, Synopsis pl. 93, fig. 11.

A delicate form with frustules 0.004 mm in breadth. Common in Kizaki Lake.

MELOSIRA ITALICA (Ehr.) Kütz. var. *VALIDA* Grun. Plate 1, fig. 7.

Melosira italica (Ehr.) Kütz. var. *valida* Grun., Fr. HUSTEDT, Bacillar (1930) 94, fig. 51.

A distinct form with frustules 0.02 to 0.03 mm in breadth and 0.027 to 0.03 mm in length. Puncta 12 in 0.01 mm. Very common in Kizaki and Aokiko Lakes in Nippon. Known from subarctic regions.

MELOSIRA ITALICA (Ehr.) Kütz. subsp. *SUBARCTICA* O. Mull. Plate 1, fig. 6.

Melosira italica (Ehr.) Kütz. subsp. *subarctica* O. Mull., Fr. HUSTEDT, Bacillar (1930) 92, fig. 52.

Frustules in long filaments, 0.0075 to 0.008 mm in breadth. Striae 18 in 0.01 mm. Puncta 24 in 0.01 mm. Known from Nippon.

CYCLOTELLA STELLIGERA Cleve and Grun. Plate I, fig. 11

Cyclotella stelligera Cleve and Grun., FR. HUSTEDT, BacHar (1930), 100 (fig. 65)

A distinct species with a ring of alveoli in the center of the valve. Diameter of the valve 0.012 mm. Striae 13 in 0.01 mm. Not common. Known from Aokko Lake.

CYCLOTELLA GLOMERATA Bachmann fo. *NIPPONICA* fo. nov. Plate I, fig. 12

A little species with circular valve consisting of a hyaline central area one-half the diameter of the valve and a rim of transverse striae. Diameter of the valve 0.0036 to 0.004 mm. Striae 18 in 0.01 mm. Differs from the type by its coarser striae. *Cyclotella glomerata* is known from several lakes of Europe.

CYCLOTELLA MENECHINIANA Kütz. var. *NIPPONICA* var. nov. Plate I, fig. 13

This new variety differs from the type by a ring of scattered beads near the marginal rim of the transverse striae. Diameter of the valve, 0.012 mm. Striae robust, 7 in 0.01 mm. Occasional in Kizaki Lake.

CYCLOTELLA COMTA Ehr. Kütz.

Cyclotella comta (Ehr.) Kütz. VAN HEURCK Synopsis pl. 92, figs 16-22.

Valve circular, consisting of a large central area, one-third the diameter of the valve and a rim one-third the valve diameter, the former with papillae finely distributed over the entire valve in rows radial from the center. Rim ornamented with delicate transverse striae. Diameter of the valve 0.001 to 0.045 mm. Very common in Kizaki Lake. Known from Aokko Lake.

CYCLOTELLA COMTA Ehr. Kütz. var. *PAUCIPUNCTATA* Grun. Plate II, fig. 2

Cyclotella comta (Ehr.) Kütz. var. *paucipunctata* Grun., VAN HEURCK Synopsis pl. 92, figs 20.

A variety with a small central area, with scattered beads forming a star in the center. Diameter of the valve, 0.012 mm. Striae 18 in 0.01 mm. Very rare. Known from Aokko Lake in Nippon.

CYCLOTELLA COMTA Ehr. Kütz. fo. *PARVA* fo. nov. Plate II, fig. 13.

Differs from the type in its smaller valve. Diameter of the valve, 0.0042 to 0.006 mm. Common in Kizaki Lake.

STEPHANODISCUS ASTRAEA (Ehr.) Grun.

Stephanodiscus astraen Ehr. Grun. VAN HEURCK Synopsis (1880), 981 pl. 95, figs 5-6

A common diatom in Kizaki Lake. Known from Aokko Lake.

TABELLARIA FLOCCULOSA (Roth.) Kütz. Plate 1, fig. 18.

Tabellaria flocculosa (Roth.) Kütz., FR. HUSTEDT, Bacillar 1930
123-124, fig. 101.

Valve linear with median inflation larger than the terminal
Common in Kizaki Lake

TABELLARIA FENESTRATA (Lyngb.) Kütz. Plate 1, fig. 21.

Tabellaria fenestrata (Lyngb.) Kütz., FR. HUSTEDT, Bacillar (1930)
122-123, fig. 99.

Valve linear, gibbous in the middle. Ends capitate. Length
0.068 mm; breadth, 0.0045. Striae 18 in 0.01 mm. Uncommon
in Kizaki Lake.

DIATOMA VULGARE Bory var. **LINEARE** Grun. Plate 10, fig. 7.

Diatoma vulgare Bory var. *lineare* Grun., A. SCHMIDT, Atlas Diatom,
pl. 266, figs. 11-17.

Valve linear with slightly truncate end. Length, 0.024 mm,
breadth, 0.0034. Striae 15 in 0.01 mm. Not common

DIATOMA HIEMALE (Lyngb.) Heiberg. Plate 1, fig. 24; Plate 2, fig. 34 Plate 10, fig. 12

Diatoma hiemale (Lyngb.) Heiberg, FR. HUSTEDT, Bacillar 1930
129, fig. 115.

Valve lanceolate, obtuse. Length, 0.02 to 0.03 mm, breadth
0.006 to 0.005. An alpine species.

DIATOMA HIEMALE (Lyngb.) Heiberg var. **MESODON** (Ehr.) Grun. Plate 10, fig. 13
Plate 9, fig. 10, Plate 10, fig. 25.

Diatoma hiemale (Lyngb.) Heiberg var. *mesodon* (Ehr.) Grun FR.
HUSTEDT, Bacillar (1930) 129, fig. 116.

Valve broad elliptic. Length, 0.012 to 0.017 mm; breadth,
0.007. An alpine diatom reported from Aokiko Lake

MERIDION CIRCULARE Agardh. Plate 1, fig. 15.

Meridion circulare Agardh, FR. HUSTEDT, Bacillar. (1930) 126-131,
fig. 118.

Valve clavate. Length, 0.032 mm, breadth, 0.0045. Costae 4
in 0.01 mm. Not common. Known from springs and mountain
streams.

MERIDION CIRCULARE Agardh var. **CONSTRICTA** (Ralfs) Van Heurck. Plate 10,
fig. 21.

Meridion circulare Agardh var. *constricta* (Ralfs) Van Heurck, FR.
HUSTEDT, Bacillar (1930) 131, fig. 119.

Valve clavate with constricted capitate ends. Length, 0.03
mm; breadth, 0.004. Not common.

OPHODORA MARTYI Heribaud. *Table 2, fig. 27. Plate 13, fig. 3.*

- Ophephora Martyi* Heribaud FR. HUSTEDT, *Bacillar* (1930) 132-133, fig. 120

Valve broad-ovate, or elongate, rounded at one end and acute at the other. Length, 0.0076 to 0.012 mm, breadth 0.0025 to

- 0.003. Costae 12 in 0.01 mm. Common in Kizaki Lake. Known from Aokubo Lake.

OPHODORA MARTYI Heribaud var. *ROBUSTA* var. nov. *Plate 13, fig. 4. Plate 13, fig. 10.*

Valve robust, convex, attenuate towards the ends. Ends broad-obtuse. Length, 0.023 to 0.042 mm; breadth, 0.0068 to 0.009. Costae 5 to 6 in 0.01 mm. Common.

OPHODORA MARTYI Heribaud var. *ELONGATA* var. nov. *Plate 13, fig. 12.*

- Valve long-ovate. One end much broader than the other. Length, 0.015 mm, breadth, 0.005. Costae 9 in 0.01 mm. A distinct variety.

OPHODORA OKADA sp. nov. *Plate 13, fig. 6.*

Valve claviform with subtruncate and usually constricted apex. End attenuate, constricted and capitate. Central area linear. Length, 0.024 to 0.03 mm, breadth, 0.0042 to 0.005. Costae 7 in 0.01 mm. A species distinct from *O. Martyi* Heribaud. Named in honor of Dr. Yoshikazu Okada, of Tokyo.

CERATONIS ARCTIS Kütz. var. *HATTORIANA* Meister. *Plate 1, fig. 38.*

- Ceratonia arctica* Kütz. var. *Hattoriana* MEISTER, *Beiträge zur Bacillar* Japan 2 (1914) 226-227 pl. 8, figs. 1-3

Valve linear with rostrate ends. Length, 0.061 mm, breadth, 0.005. Striae 12 in 0.01 mm. Not common in Kizaki Lake. Reported from Yokohama.

CERATONIS ARCTIS Kütz. var. *AMPHIOXYS* (Rabenh.) *Plate 1, fig. 38. Plate 11, figs. 13 and 14.*

- Ceratonia arctica* Kütz. var. *amphioxys* (Rabenh.) FR. HUSTEDT, *Bacillar* 1930) 135, fig. 123.

Valve lanceolate with asymmetrical sides. Length 0.017 to 0.032 mm, breadth 0.0045 to 0.006. Striae 15 to 18 in 0.01 mm. Common in Kizaki Lake.

FRAGILARIA HARRISONII W. Smith. *Plate 14, fig. 2.*

- Fragilaria Harrisonii* W. Smith FR. HUSTEDT, *Bacillar* 1930) 139-140, fig. 132.

Valve broad cross-shaped with rounded ends. Length, 0.014 mm; breadth, 0.008. Pseudoraphe narrow. Costae very distinct. A fresh-water diatom.

FRAGILARIA HARRISONII W. Smith var. RHOMBOIDES Grun. Plate 14, fig. 4

Fragilaria Harrisonii W. Smith var. *rhomboides* Grun., FR. HUSTEDT, Bacillar. (1930) 140, fig. 133.

Valve broad-lanceolate. Length, 0.01 mm, breadth, 0.005. Costae robust, 9 in 0.01 mm.

FRAGILARIA HARRISONII W. Smith var. DUBIA Grun. Plate 14, fig. 5

Fragilaria Harrisonii W. Smith var. *dubia* Grun., FR. HUSTEDT, Bacillar. (1930) 140, fig. 134.

Valve lanceolate with attenuate and capitate ends. Length 0.0187 mm; breadth, 0.005. Costae robust, 9 in 0.01 mm. Not common. Known in European lakes.

FRAGILARIA PINNATA Ehr. Plate 1, fig. 9; Plate 12, fig. 21

Fragilaria pinnata Ehr., FR. HUSTEDT, Bacillar. (1930) 142, fig. 141b.

Valve elliptical, with broad ends. Length, 0.0034 to 0.006 mm; breadth, 0.0027 to 0.0034. Costae 12 in 0.01 mm. A fresh-water diatom. In Kizaki Lake variety *laucellula* is reported.

FRAGILARIA CROTOMENSIS Kitton. Plate 1, fig. 24.

Fragilaria crotomensis Kitton, FR. HUSTEDT, Bacillar. (1930) 137 138, fig. 125.

Valve linear-lanceolate with long-acuminate ends. Length, 0.12 to 0.015 mm; breadth, 0.003. Striae 12 to 13 in 0.01 mm. Common in fresh water. Known from Aokiko Lake.

FRAGILARIA GRACILLIMA Mayer. Plate 1, fig. 22.

Fragilaria gracillima Mayer, FR. HUSTEDT, Bacillar. (1930) 129, fig. 121.

Valve long-lanceolate with capitate and constricted ends. Pseudoraphe very narrow, indistinct. Length 0.018 mm, breadth, 0.002. Striae very fine, 24 in 0.01 mm. This species is reported from Germany only.

FRAGILARIA CAPUCINA Desm. Plate 1, fig. 23.

Fragilaria capucina Desm., FR. HUSTEDT, Bacillar. (1930) 138, fig. 126.

Valve sublinear with slightly rostrate and obtuse ends. Length, 0.04 mm; breadth, 0.004. Striae 12 in 0.01 mm. Pseudoraphe very narrow. In the middle part of the valve the striae are interrupted, forming a quadrate central area. A plankton species, known also from Aokiko Lake in Nippon.

FRAGILARIA VIRESCENS Ralfs. Plate 9, fig. 15.

Fragilaria virescens Ralfs, FR. HUSTEDT, Bacillar. (1930) 142, fig. 144.

Valve lanceolate, rostrate and obtuse. Length, 0.017 mm; breadth, 0.005. Striae 18 in 0.01 mm. Pseudoraphe very

narrow and linear. Very common in Kizaki Lake. Known from many parts of the world.

FRAGILARIA VIRESCENS Halle var. *ELLIPTICA* Husted (cf. *NIPPONICA* Lo. nov.
Plate 12, fig. 28.

Valve lanceolate, dilated, obtuse, not rostrate. Length, 0.009 mm, breadth, 0.003. Striae 18 in 0.01 mm. This form differs from variety *elliptica* in having narrower valves.

FRAGILARIA BREVISTRATA Grun. Plate 14, fig. 3.

Fragilaria brevistrata Grun., F.E. HUSTED, Bacillar (1930) 146 fig. 151.

Valve lanceolate with acute ends. Length, 0.015 mm; breadth, 0.0034. Striae 18 in 0.01 mm, marginal. Common.

FRAGILARIA BREVISTRATA Grun. var. *INFLATA* (Pant.) Husted (cf. *CURTA* Lo. nov. Plate 1, fig. 18.

Valve short, lanceolate, with attenuate, obtuse ends. Length 0.0085 mm, breadth, 0.0034. Striae 15 in 0.01 mm. The typical variety *inflata* has a more elongate valve.

FRAGILARIA BREVISTRATA Grun. var. *NIPPONICA* var. nov. Plate 15, fig. 7.

Valve lanceolate, biconstricted, with rostrate ends. Length 0.02 mm, breadth, 0.005. Striae 15 to 17 in 0.01 mm. This diatom resembles, under a low power, *Fragilaria Magocsyn* Lacyn known from Hungary, from which, however, it is different.

FRAGILARIA CONSTRUCENS (Ehr.) Grun. Plate 1, figs. 73 and 79.

Fragilaria construens (Ehr.) Grun., A. SCHMIDT Atlas Diatom. pl. 296, figs. 46-47.

Valve broad-lanceolate with rostrate ends. Length, 0.008 to 0.01 mm; breadth, 0.004 to 0.006. Striae 15 to 18 in 0.01 mm. This diatom is widely distributed in fresh waters.

FRAGILARIA CONSTRUCENS (Ehr.) Grun. var. *SUBSALINA* Husted. Plate 11, fig. 19.

Fragilaria construens (Ehr.) Grun. var. *subsalina* HUSTED, Bacillar (1930) 141, fig. 139.

Valve linear-lanceolate with obtuse ends. Length, 0.012 mm, breadth, 0.0032. Striae 15 in 0.01 mm. This variety differs from the type in its narrower valves. It is known from brackish waters of Europe.

FRAGILARIA CONSTRIENS Ehr. Grun. var. TRUNDULATA Reichelt Plate 10, fig. 37

Fragilaria constriens Ehr. Grun. var. *trundulata* Reichelt FR. HUSTEDT, Bac. ar. (1930) 140, fig. 136

Valve ancelolate, triundulate with rostrate ends. Length, 0.02 mm breadth 0.005 Striae 18 in 0.01 mm Pseudoraphe linear Not common in Kizaki Lake

FRAGILARIA CONSTRIENS (Ehr. Grun. var. BINODIS Ehr. Grun. Plate 10, fig. 37 Plate 16, fig. 3

Fragilaria constriens Ehr. Grun. var. *binodis* (Ehr. Grun., FR. HUSTEDT, Bac. ar. (1930) 140-141 fig. 137

Valve biconstricted Length 0.017 to 0.02 mm breadth, 0.001 to 0.002 Striae 15 in 0.01 mm Variety *binodis* is reported from Aokiko Lake

FRAGILARIA CONSTRIENS (Ehr. Grun. var. NIPPONICA var. nov. Plate 10, fig. 3 Plate 16, fig. 3

Valve minute broad ancelolate with rostrate ends constricted from one or from both sides Length 0.009 to 0.011 mm, breadth 0.005 Striae 15 in 0.01 mm This differs from variety *binodis* in its shorter axes.

ASTERONELLA GRACILLIMA (Hantzsch) Hustberg Plate figs 33 and 34

Asteronella gracillima (Hantzsch) Hustberg FR. HUSTEDT, Bac. ar. (1930) 147 fig. 140

Valve linear with capitate ends. Length 0.072 to 0.08 mm, breadth 0.002 Abundant in Kizaki Lake.

SYNEDRA NANA Meister var. NIPPONICA var. nov. Plate 8 fig. 29

Valve sublinear, attenuate towards the ends. Length 0.026 to 0.049 mm breadth 0.0017 to 0.002 Striae marginal very fine about 30 to 35 in 0.01 mm Differs from the type in its slightly convex margins.

SYNEDRA LUNA Nitzsch Ehr. Plate fig. 36 Plate 3, fig. 8

Synedra (Luna) Nitzsch Ehr. FR. HUSTEDT, Bac. ar. (1930) 151 fig. 159

Valve linear arcelolate with broad ends. Length 0.136 to 0.221 mm breadth 0.006 to 0.008 Striae 9 to 10 in 0.01 mm Common in fresh water

SYNEDRA LUNA Nitzsch Ehr. var. RAMESI Hustb. and Perag. Husted Plate fig. 37

Synedra (Luna) Nitzsch Ehr. var. *Ramesi* (Hustb. and Perag.) Husted FR. HUSTEDT, Bac. ar. (1930) 152 fig. 160

Valve linear-lanceolate, little constricted and with truncate ends. Length 0.054 mm, breadth, 0.006. Striae 11 to 12 in 0.01 mm. Uncommon.

SYNEDRA (LINA) Nitzsch Ehr. var. *BICEPS* Kütz. Plate 1, fig. 2.

Synedra (Lina) Nitzsch Ehr. var. *biceps* (Kütz.) FR. HUSTEDT, *Bacillar* (1930) 154, fig. 166.

Valve long linear with capitate ends. Length 0.2 to 0.25 mm, breadth, 0.0045. Striae 85 in 0.01 mm. Common in Kizak Lake.

SYNEDRA (LINA) Nitzsch Ehr. var. *DANICA* Kütz. *Grün.* Plate 6, fig. 6.

Synedra (Lina) Nitzsch Ehr. var. *danica* Kütz. *Grün. Pl. HUSTEDT*, *Bacillar* (1930) 154, fig. 168.

Valve lanceolate, attenuated towards the ends. Ends slightly subtruncate and constricted. Length, 0.17 mm, breadth, 0.006. Striae 9 in 0.01 mm.

SYNEDRA COLIARDI (Breb.) *Grün.* Plate 10, fig. 2*

Synedra Coliardi (Breb.) *Grün. A. STEINERT Atlas Diatom pl.* 300, figs. 10-18.

Valve deep, constricted with truncate-rostrate ends. Length 0.039 mm, breadth, 0.0065. Striae 15 in 0.01 mm. Known from Demerara River, Paraguay, and from Victoria Lake, Africa.

SYNEDRA RUMPFENS Kütz. var. *MENEGHINIANA* *Grün.* Plate 2, fig. 12.

Synedra rumpfens Kütz. var. *Meneghiniana* *Grün. FR. HUSTEDT*, *Bacillar* (1930) 56, fig. 178.

Valve lanceolate with truncate ends. Length, 0.03 mm, breadth, 0.025. Striae 12 in 0.01 mm. Not common.

SYNEDRA RUMPFENS Kütz. var. *NIPPONICA* var. nov. Plate 1, fig. 20.

Valve sub near, narrowly attenuated towards the ends. Striae very fine, 30 in 0.01 mm, interrupted in the middle part, forming a rectangular area. Length 0.03 mm, breadth, 0.003. Differs from the type in its fine striae.

SYNEDRA CYCLOPSUM Brebachi var. *NIPPONICA* var. nov. Plate 13, fig. 3.

Valve linear-lanceolate, sigmoid attenuate towards the ends. Length, 0.018 mm, breadth, 0.002. Striae 18 in 0.01 mm. The typical forms of *Synedra cyclopsum* have the valves larger and they are curved to one side. *Synedra cyclopsum* is reported from Europe.

SYNEDRA JAPONICA Meister Plate 1, fig. 27 Plate 10, fig. 9.

Synedra japonica MEISTER, Beiträge zur Bac. Mar. Japans (1913) 307, figs. 5-6

Valve linear-lanceolate with long capitate horns. Length, 0.144 to 0.187 mm, breadth, 0.0028 to 0.003. Striae 11 to 13 in 0.01 mm, interrupted in the middle and forming a quadrate area. Pseudoraphe very narrow. Common in Kizaki Lake. Known from Suwa Lake, Nippon.

SYNEDRA VAUCHERIE Kütz. Plate 1, fig. 14.

Synedra Vaucheriei Kütz. FR. HUSTEDT, Bacillar. (1930) 161, fig. 182.

Valve lanceolate, broad and obtuse. Length, 0.012 mm; breadth, 0.0025. Striae 16 in 0.01 mm. Common in Kizaki Lake.

SYNEDRA VAUCHERIE Kütz. var. CAPITELLATA Grun. Plate 1, fig. 15; Plate 2, fig. 21.

Synedra Vaucheriei Kütz. var. *capitellata* Grun. FR. HUSTEDT Bacillar. (1930) 161, fig. 194.

Valve lanceolate, attenuate towards the ends. Ends capitate. Length, 0.018 to 0.023 mm; breadth 0.0028 to 0.0042. Striae 12 to 16 in 0.01 mm.

SYNEDRA VAUCHERIE Kütz. var. SIGMOIDEA var. nov. Plate 1, fig. 16

Valve lanceolate, sigmoid, with capitate ends, turned opposite. Length, 0.02 mm; breadth, 0.004. Striae fine, 18 in 0.01 mm. Not common in Kizaki Lake.

SYNEDRA PARASITICA (W. Smith) Plate 1, fig. 22.

Fragilaria parasitica W. Smith, A. SCHMIDT Atlas Diatom pl. 296, figs. 76-80.

Valve lanceolate, convex, with produced ends. Pseudoraphe wide. Length 0.012 to 0.02 mm; breadth, 0.004 to 0.006. Striae 18 in 0.01 mm. Meister described *Fragilaria parasitica* var. *asterionellodes* from Nippon, a variety forming asterionelloid colonies.

SYNEDRA NIPPONICA sp. nov. Plate 1, fig. 43.

Valve minute, lanceolate, attenuate towards the ends. Pseudoraphe very narrow. Length 0.01 mm, breadth, 0.002. Striae 18 in 0.01 mm. A species related to *Synedra parasitica*.

ACTINELLA BRASILIENSIS Grun. Plate 2, fig. 44

Actinella brasiliensis Grun. A. SCHMIDT, Atlas Diatom pl. 292, figs. 10-19

Valve linear inflated at one end, capitate and apiculate. Length, 0.088 mm breadth 0.013 Striae 10 in 0.01 mm Not common in Kizaki Lake. Reported from Brazil, Chosen and Hanka Lake in Siberia and as a fossil in southern Europe.

EUNOTIA SEPTENTRIONALIS Oestrup. Plate 2. fig. 23.

Eunotia septentrionalis Oestrup. FR. HUSTEDT. Bacillar (1930) 179, fig. 232

Valve lanceolate with gibbous dorsal and parallel ventral sides. Length, 0.0136 mm, breadth, 0.0024 Striae 18 in 0.01 mm. Not common in Kizaki Lake. Reported from Germany as a relict.

EUNOTIA TROPICA Hustedt. Plate 8. figs. 19 and 15.

Eunotia tropica HUSTEDT. Bacillar and Aokikosee in Japan 159 p. 5. fig. 1

Valve robust with four or five undulations on the dorsal side. Length, 0.078 to 0.088 mm breadth 0.017 Striae 8 to 9 in 0.01 mm. Uncommon in Kizaki Lake. Known from Aokiko Lake from Foochow, southern China and, according to Fr. Hustedt from the Tropics.

EUNOTIA FABA (Ehr.) Grun. var. *NIPPONICA* var. nov. Plate 14. fig. 4.

Valve linear and obtuse. Length, 0.013 to 0.016 mm, breadth, 0.0028 to 0.003 Striae fine, 18 in 0.01 mm. Typical *Eunotia faba* has larger valves, and is an alpine plant.

EUNOTIA PALUDOSA Grun. Plate 1. fig. 25.

Eunotia paludosa Grun., FR. HUSTEDT. Bacillar (1930) 178, fig. 228

Valve linear, curved, with rostrate-truncate ends. Length, 0.047 mm, breadth 0.005. Striae 12 in 0.01 mm. Reported from Europe.

EUNOTIA LUNARIS (Ehr.) Grun. Plate 1. fig. 44.

Eunotia lunaris (Ehr.) Grun. FR. HUSTEDT. Bacillar (1930) 183 fig. 249

Valve linear curved. Length 0.085 mm breadth, 0.0025 Striae 18 in 0.01 mm. Uncommon in Kizaki Lake.

EUNOTIA GRACILIS (Ehr.) Rabh. Plate 1. fig. 40.

Eunotia gracilis (Ehr.) Rabh. FR. HUSTEDT, Bacillar (1930) 185 fig. 253

Valve long, curved with capitate ends. Length, 0.111 mm, breadth, 0.005 Striae 12 in 0.01 mm. Occasional in Kizaki Lake.

EUNOTIA VALIDA Husted† Plate 1, fig. 41

E. notia valida H. STEDT, Bac. ar. 1930 178, fig. 229

Valve linear, robust, with obtuse ends. Length, 0.096 mm, breadth, 0.0042. Striae 12 in 0.01 mm. Reported from wet rocks from Europe

EUNOTIA VENERIS (Kütz.) O. Muhl. var. *NIPPONICA* var. nov. Plate 1, fig. 31

Valve lanceolate-attenuate towards the ends. Length, 0.0187 mm, breadth, 0.0034. Striae 15 in 0.01 mm. Differs from the type in having broader ends

EUNOTIA PRÆLEPTA Ehr. Plate 12, fig. 25.

Eunotia prælepta Ehr., FR. HUSTEDT, Bac. ar. 1930 174, fig. 211

Valve robust, curved, with convex dorsal sides. Length, 0.051 mm, breadth, 0.01. Striae 12 to 15 in 0.01 mm. An alpine diatom

EUNOTIA PECTINALIS Kütz. Rabh. var. *MINOR* Kütz. Rabh. Plate 1, fig. 30

Eunotia pectinalis Kütz. Rabh. var. *minor* (Kütz.) Rabh. FR. HUSTEDT, Bac. ar. 1930 182, fig. 258

Valve linear, curvate, slightly attenuate and obtuse. Length, 0.03 mm, breadth, 0.006. Striae 10 to 11 in 0.01 mm. Common in fresh water

EUNOTIA PECTINALIS Kütz. Rabh. var. *MINOR* Kütz. Rabh. fo. *IMPRESSA* (Ehr.) Plate 1, fig. 30

Eunotia pectinalis (Kütz.) Rabh. var. *minor* (Kütz.) Rabh. fo. *impressa* Ehr. FR. HUSTEDT, Bac. ar. 1930 182, fig. 239

Valve lanceolate, curvate, constricted on the dorsal side. Length, 0.022 mm, breadth, 0.004. Striae 15 in 0.01 mm. Common in marsh water

EUNOTIA PECTINALIS Kütz. Rabh. var. *NIPPONICA* var. nov. Plate 1, fig. 32

Valve lanceolate-attenuate towards the ends, obtuse. Two interruptions in the middle of the ventral side. Length, 0.019 mm, breadth, 0.0048. Striae 15 in 0.01 mm. Differs from the type by its interruptions.

COCONEIS PLACINTULA (Ehr.) var. *LINEATA* Ehr. Cleve. Plate 2, fig. 5

Cocconeis placintula (Ehr.) var. *lineata* (Ehr.) Cleve, FR. HUSTEDT, Bac. ar. 1930 190, fig. 362

Valve elliptical with broad ends. Length, 0.022 mm, breadth, 0.012. Striae 18 to 20 in 0.01 mm. Common in fresh water

COCconeis PLACENTULA Ehrh. var. *MINORAPHIS* Gentler f. *NIPPONICA* f. nov.
Plate 2, fig. 8

Valve elliptical with a curvate median line. Length, 0.030 mm breadth, 0.018. Striae 24 in 0.01 mm. Differs from variety *minoraphis* in its broad rounded ends.

COCconeis DISTINCTA Parva. Plate 2, figs. 16 to 18

Cocconeis distincta Parva f. nov. Fr. HISTEDT Bac. Ind. (1930) 130, fig. 265

Valve broadly elliptical. Length, 0.008 to 0.018 mm breadth, 0.005 to 0.01. Upper valve with linear axial area. Striae 22 in 0.01 mm. Lower valve with ancoolate axial area with coarse elongate puncta. 12 in 0.01 mm. Common. Known from Nippon.

COCconeis FLEXUOSA Grun. Plate 2, fig. 39

Cocconeis flexuosa Grun. f. nov. Fr. HISTEDT Bac. Ind. (1930) 133, fig. 270.

Valve elliptical with an arcuate median line. Length 0.035 mm breadth, 0.015. Common in a peat waters.

ACHNANTHES MICROCEPHALA Kütz. Plate 2, fig. 22

Achnanthes microcephala (Kütz.) Fr. HISTEDT Bac. Ind. (1930) 128, fig. 273

Valve linear with subcapitate ends. Length 0.018 mm, breadth, 0.0025. Striae no striae. Known from fresh water in Europe.

ACHNANTHES KIZAKI sp. nov. Plate 2, fig. 75

Valve linear enlarged in the middle with broad, capitate ends. Length 0.013 mm breadth 0.002. Upper valve with a narrow near axial area and a narrow rectangular central area. Lower valve with slightly dilated central area. Striae very fine about 40 in 0.01 mm. A species related to *A. microcephala* Kütz.

ACHNANTHES HAUCKIANA Grun. Plate 2, fig. 26

Achnanthes hauckiana Grun. f. nov. Fr. HISTEDT Bac. Ind. (1930) 129, fig. 290

Valve elliptical-obovate. Length, 0.015 mm breadth, 0.005. Upper valve with a linear axial area. Striae 14 in 0.01 mm. Lower valve with a broad central area. Striae radiate. Known from hot springs and brackish water.

ACHNANTHES BAUCKIANA Grun. var. *ELLIPTICA* Schult. *Id.* *NEPTUNICA* *Id.* nov.
Plate 14, fig. 6

Valve elliptical. Length, 0.01 mm., breadth, 0.042. Upper valve with linear axial area. Striae 18 in 0.01 mm., radiate. Lower valve with a broad central area. Differs from variety *elliptica* in its coarser striae.

ACHNANTHES OESTRUPII (A. Cleve) Hustedt. Plate 2, figs. 21 and 22; Plate 12, fig. 17.

Achnanthes Oestrupii (A. Cleve) Hustedt, Bacillar. (1930) 257, fig. 301.

Valve broad-elliptical. Length, 0.09 to 0.015 mm.; breadth, 0.007 to 0.0085. Upper valve with a linear axial area, on one side of which in the middle of the valve there is a horseshoe-shaped area. Striae robust, radiate, 12 to 18 in 0.01 mm. Lower valve with a narrow striae. Striae very fine, about 35 in 0.01 mm. Known from Europe.

ACHNANTHES CLEVEL Grun. var. *NIPPONICA* A. var. nov. Plate 2, fig. 21.

Valve lanceolate, convex, acute-obtuse. Length, 0.014 mm., breadth, 0.005. Upper valve with narrow, linear, axial area. Striae distinctly punctate, 12 in 0.01 mm., radiate. Puncta 15 in 0.01 mm. Lower valve with narrow central area. Striae very fine, 20 to 22 in 0.01 mm. Differs from the type in its obtuse ends and differs from variety *rostrata* Hustedt in its broad end. *Achnanthes Clevei* is known from Europe.

ACHNANTHES EXIGUA Grun. Plate 2, fig. 18.

Achnanthes exigua Grun., Fr. HUSTEDT, Bacillar. (1930) 201-202, fig. 288.

Valve elliptical with rostrate ends. Length, 0.015 mm.; breadth, 0.006. Striae 24 in 0.01 mm. Known from fresh water and hot springs. Reported from Aokiko Lake.

ACHNANTHES EXIGUA Grun. var. *INDICA* Skvortzow. Plate 2, fig. 20.

Achnanthes exigua Grun. var. *INDICA* SKVORTZOW, Diatoms from Calcutta (1935) p. 1, fig. 3.

Valve minute, broad-ovate. Length, 0.0068 mm.; breadth, 0.0042. Upper valve with narrow axial area. Striae parallel, 18 to 20 in 0.01 mm. Lower valve with narrow axial area, and with central area forming a short striae with one median shortened stria opposite the striae. Recently described by me from Calcutta, India.

ACHNANTHES EXIGUA Grun. var. *NIPPONICA* var. nov. Plate 2, figs. 7 and 8.

Valve elliptical with rostrate ends. Length, 0.012 mm.; breadth, 0.0062. Upper valve with a narrow axial area. Striae

18 in 0.01 mm parallel at the ends slightly radiate. Lower valve with a median stria, opposite to the fascia being shortened. The type of *Achnanthes elliptica* Grun. differs from variety *supplicata* in its bilateral broad fascia.

ACHNANTHES PERAGALLII Brun and Hermbold. Plate 2, fig. 30.

Achnanthes Peragalli Brun and Hermbold. Diatom d'Auvergne (1893) 50, pl. 1 fig. 4.

Valve broadly elliptical with apiculate ends. Length, 0.012 mm, breadth 0.006. Upper valve with lanceolate axial area, on one side of which there is a horseshoe area. Striae 18 in 0.01 mm. Lower valve with a dilated central area. Known from Aokiko Lake.

ACHNANTHES PERAGALLII Brun and Hermbold var. *NIPPONICA* var. nov. Plate 2, fig. 30.

Valve lanceolate convex, with long attenuate ends. Length 0.025 mm, breadth, 0.0035. Upper valve with a broad axial area. Central area of the lower valve with a broad stria. Differs from the type in its more elongate shape. Common in Kizaki Lake.

ACHNANTHES GRACILLIMA Husted var. *NIPPONICA* var. nov. Plate 4, figs. 3 and 4. Plate 6, fig. 9.

Valve slightly siliceous, narrow lanceolate with attenuate and capitate ends. Length, 0.015 to 0.018 mm, breadth, 0.0034 to 0.0036. Upper valve with indistinct axial area. Lower valve with a narrow axial area outwardly dilated. Striae very fine indistinct. Common in Kizaki Lake. The type is reported from Aokiko Lake.

ACHNANTHES AFFINIS Grun. var. *MINUTA* var. nov. Plate 10, fig. 27.

Valve linear lanceolate with obtuse ends. Length, 0.0085 mm, breadth 0.0017. Upper valve with a narrow axial area. Striae radiate very fine, in the middle 30, at the ends 40, in 0.01 mm. Lower valve with a dilated central area. The type of *Achnanthes affinis* occurs in fresh waters of Europe, Tasmania, and North America.

ACHNANTHES MINUTISSIMA Kütz. Plate 2, figs. 1 and 23.

Achnanthes minutissima Kütz. Fr. LESTER. Diatom (1930, 193, fig. 274).

Valve linear with attenuate and obtuse ends. Length 0.013 to 0.022 mm, breadth 0.002 to 0.005. Striae 28 in 0.01 mm or very fine and indistinct. Not common.

ACHNANTHES MINUTISSIMA Kütz. var. *CRYPTOCEPHALA* Grun. Plate 2, fig. 1.

Achnanthes minutissima Kütz. var. *cryptocephala* Grun. FR. HUSTEDT, Bacillar. (1930) 198, fig. 215.

Valve linear with capitate ends. Length, 0.015 mm., breadth, 0.002. Striae 30 in 0.01 mm. Uncommon.

ACHNANTHES LINEARIS W. Smith var. *PUSILLA* Grun. Plate 10, fig. 17

Achnanthes linearis W. Smith var. *pusilla* Grun., FR. HUSTEDT, Bacillar. (1930) 198, fig. 277

Valve elongate-linear with obtuse ends. Length, 0.012 mm., breadth, 0.002. Striae widened in the middle part of the valve, 24 in 0.01 mm. Known from Greenland and Norway

ACHNANTHES LANCEOLATA Breh. Plate 2, figs. 11 and 12.

Achnanthes lanceolata Breh., FR. HUSTEDT, Bacillar. (1930) 207 fig. 306a.

Valve elliptic-lanceolate, ends obtuse. Length, 0.0136 mm., breadth, 0.005. Upper valve with lanceolate axial area and with a horseshoe area on one of the sides. Lower valve with a quadrate or rectangular central area. Striae 15 in 0.01 mm. Common in fresh water. Known from Aokiko Lake.

ACHNANTHES LANCEOLATA Breh. var. *ELLIPTICA* Cleve. Plate 2, fig. 13

Achnanthes lanceolata Breh. var. *elliptica* Cleve, FR. HUSTEDT, Bacillar. (1930) 208, fig. 306c.

Valve elliptic, obtuse. Length, 0.015 mm.; breadth, 0.0085. Striae 18 in 0.01 mm. An alpine species, reported from Europe.

ACHNANTHES LANCEOLATA Breh. var. *ROSTRATA* Hustedt. Plate 2, fig. 14. Plate 3, fig. 1. Plate 10, fig. 15.

Achnanthes lanceolata Breh. var. *rostrata* HUSTEDT, Bacillar. (1930) 207-208, fig. 306b.

Valve elliptical with rostrate ends. Length, 0.012 to 0.018 mm., breadth, 0.005 to 0.0068. Upper valve with a lanceolate axial area and on one side with a horseshoe area. Striae robust, 12 to 18 in 0.01 mm.

ACHNANTHES LANCEOLATA Breh. var. *NIFFOSICA* var. nov. Plate 12, fig. 15.

Valve broad-lanceolate, slightly gibbous in the middle narrowed towards the ends. Length, 0.016 mm.; breadth, 0.006. Upper valve with a lanceolate axial area and with a horseshoe area on one side. Lower valve with a rectangular central area. Striae 12 in 0.01 mm. Not common.

ACHNANTHES PINNATA Hustedt var. *JAPONICA* Hustedt. Plate 2, fig. 15. Plate 4, fig. 26.

Achnanthes pinnata Hustedt var. *japonica* HUSTEDT, Bacillar. a. d. Aokikosee in Japan 161, pl. 5, figs. 12-16.

Valve minute, elliptic and obtuse. Length, 0.0051 to 0.006 mm, breadth, 0.0034. Upper valve with very narrow axial area. Striae 18 in 0.01 mm. Lower valve with indistinct axial area and with a small central area. Reported only from Aokiko Lake, Nippon.

NAME: *OSPHEENIA CURVATA* (Kütz.) Grun.

Rhacosphena curvata (Kütz.) Grun, FR. HUSTEDT, *Bacillar.* (1930) 311, fig. 311.

Valve clavate. Length, 0.049 mm; breadth, 0.0023. Common in fresh and brackish water.

AMPHIPLEURA PRILLUCIDA Kütz. Plate 3, fig. 3.

Amphipleura prillucida Kütz., FR. HUSTEDT, *Bacillar.* (1930) 218 fig. 321

Valve lanceolate-attenuate. Length, 0.085 mm; breadth, 0.007. Striae very fine. Found in fresh and slightly brackish water. Known from Nippon.

AMPHIPLEURA PRILLUCIDA Kütz. var. *RECTA* Kütz. Plate 3, fig. 3.

Amphipleura prillucida Kütz. var. *recta* Kütz., Journ. Quakett Met. Soc. 2: 21, pl. 4, fig. 4

Valve linear with gently cuneate ends. Length, 0.2 mm; breadth, 0.013. Striae 30 in 0.01 mm. According to Kütz. variety *recta* is a marine diatom found in Nippon. Reported by me from a mountain stream in southern China (Fochow, Fukien Province).

FRUSTULIA VULGARIS Thwaites. Plate 3, fig. 11.

Frustulia vulgaris Thwaites. FR. HUSTEDT, *Bacillar.* (1930) 221, fig. 327.

Valve linear and obtuse. Length, 0.044 mm; breadth, 0.0085. Striae very fine. Not common. Reported from Nippon.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni. Plate 4, fig. 19.

Frustulia rhomboides (Ehr.) de Toni, FR. HUSTEDT, *Bacillar.* (1930) 220, fig. 323

Valve rhombic-lanceolate, attenuate with obtuse ends. Length, 0.17 mm; breadth, 0.03. Central nodule small or elongate. Striae 24 in 0.01 mm. Common in fresh water.

FRUSTULIA RHOMBOIDES (Ehr.) de Toni var. *AMPHIPLEUROIDES* Grun. Plate 4, fig. 19.

Frustulia rhomboides (Ehr.) de Toni var. *amphipleuroides* Grun. FR. HUSTEDT, *Bacillar.* (1930) 221, fig. 325.

Valve lanceolate, obtuse. Length, 0.127 mm; breadth, 0.018. Striae 24 in 0.01 mm. Reported from Aokiko Lake, Nippon.

FRUSTULA RHOMBOIDES Ehr. de Toni var. *SAXONICA* Rabh. de Toni fo. *CAPITATA* A. Mayer. Plate 4 fig. 12

Frustula rhomboides Ehr. de Toni var. *saxonica* (Rabh.) de Toni fo. *capitata* A. Mayer, FR. HUSTEDT, Bacillar. (1930) 221

Valve lanceolate with capitate ends. Length, 0.044 mm, breadth, 0.013. Uncommon.

FRUSTULA RHOMBOIDES (Ehr. de Toni var. *SAXONICA* Rabh.) de Toni fo. *UNDULATA* Hustedt

Frustula rhomboides (Ehr. de Toni var. *saxonica* (Rabh.) de Toni fo. *undulata* HUSTEDT, Bacillar. (1930) 221

Valve slightly truncate with capitate ends. Length, 0.056 mm, breadth, 0.012. Rare in Kizaki Lake.

GYROSIGMA ACUMINATUM Kütz. Rabh. Plate 5, fig. 14

Gyrosigma acuminatum Kütz. Rabh. FR. HUSTEDT, Bacillar. (1930) 222-223, fig. 309.

Valve with longitudinal and transverse striae, 18 in 0.01 mm. Length, 0.136 mm, breadth, 0.02. Common.

GYROSIGMA KUTZINGI (Grun. Cleve. Plate 5, fig. 7)

Gyrosigma Kütz. (Grun. Cleve FR. HUSTEDT, Bacillar. (1930) 224, fig. 333.

Valve sigmoid and attenuate. Length, 0.098 mm, breadth, 0.012. Striae, transversal 18, longitudinal 30, in 0.01 mm. A fresh-water species. Known from Nippon.

GYROSIGMA SCALPROIDES (Rabh.) Cleve. Plate 12, fig. 1.

Gyrosigma scalproides (Rabh.) Cleve, FR. HUSTEDT, Bacillar. (1930) 226, fig. 338.

Valve sigmoid with broad ends. Striae, longitudinal 30, transversal 24, in 0.01 mm. Length 0.064 mm, breadth 0.008. Known from Europe, America and Africa.

CALONEIS STILICULA Ehr. Cleve var. *TRUNCATULA* Grun. fo. *NIPPONICA* fo. nov. Plate 5, fig. 2.

Valve truncate with broad ends. Length, 0.102 mm, breadth 0.015. Striae radiate, 18 in 0.01 mm. Differs from the type in its broad and long ends.

CALONEIS SILICULA (Ehr.) Cleve var. *TRUNCATULA* Grun. Plate 4, fig. 17.

Caloneis silicula (Ehr.) Cleve var. *truncatula* Grun., FR. HUSTEDT, Bacillar. (1930) 238, fig. 363.

Valve slightly undulate in the middle part. Central area a broad fascia. Length, 0.022 mm, breadth, 0.0058. Striae 24 in 0.01 mm. Common in fresh water.

CALOEIS SIPICULA (Ehr.) Cleve var. *BANCALENSIS* Skvortzow and Meyer. Plate 3, fig. 2.

Catonella siliola (Ehr.) Cleve var. *bancalensis* Skvortzow and Meyer, Contribut. diatoms of Baikal Lake (1928) 12, pl. 1, fig. 44.

Valve linear, triundulate with broad capitate ends. Striae 24 in 0.01 mm. Central area with a broad stauros. Length, 0.061 mm; breadth, 0.011. Reported from Baikal Lake, Siberia.

NEIDUM HITCHCOCKII Ehr. Plate 4, fig. 1.

Neidium Hitchcockii Ehr., A. Schmidt, Atlas Diatom. pl. 49, figs. 35-36.

Valve elliptic, triundulate with rostrate ends. Length, 0.057 mm; breadth, 0.013. Striae 18 in 0.01 mm. Common in fresh water.

NEIDUM PRODUCTUM (W. Smith) Cleve fo. *CONSTRICTA* Husted. Plate 4, fig. 2.

Neidium productum (W. Smith) Cleve fo. *constricta* HUSTED, Bacillar. (1930) 246.

Valve constricted with apiculate ends. Length, 0.049 mm, breadth 0.011. Striae 24 in 0.01 mm.

NEIDUM AFFINE (Ehr.) Cleve fo. *HERCYNICA* (A. Mayer) Hust. Plate 4, fig. 3.

Neidium affine (Ehr.) Cleve fo. *hercynica* (A. Mayer) HUSTED, Bac. lxx. (1930) 243.

Neidium affine var. *germanica* CLEVE, Bacillar. d. Regensburger Gewässer (1913) 109, pl. 10, fig. 32.

Valve lanceolate with obtuse ends. Length, 0.037 mm, breadth, 0.01. Striae 20 to 24 in 0.01 mm. Known from Europe.

NEIDUM SUBULCATUM (Lagard.) Cleve var. *NIIPPONICA* var. nov. Plate 3, fig. 1. Plate 4, fig. 5.

Valve linear-lanceolate with slightly attenuate ends. Length, 0.034 to 0.06 mm; breadth, 0.006 to 0.01. Striae 20 to 30 in 0.01 mm. Differs from the type in its attenuate and acute ends. The type is common in alpine regions.

NEIDUM DUBIUM (Ehr.) Cleve. Plate 12, fig. 10.

Neidium dubium (Ehr.) Cleve, Fa. Husted, Bacillar. (1930) 246, fig. 325.

Valve broad-lanceolate with acuminate ends. Length, 0.034 mm, breadth, 0.01. Striae 13 in 0.01 mm. Common in fresh and brackish waters.

NEIDUM NIIPPONICA sp. nov. Plate 3, fig. 1.

Valve large, lanceolate with obtuse ends. Striae oblique, 18 in 0.01 mm, crossed by longitudinal marginal band. Axial area

narrow, widened on the middle part of each end. Central area broad. Length, 0.142 mm, breadth, 0.025. A distinct species; it resembles *Navicula* sp. figured in A. Schmidt, Atlas Diatom pl. 49, fig. 1 from Monticello, New York.

NEIDIUM KOZLOVI Mereschk. var. *NIPPONICA* var. nov. Plate 1st fig. 19.

Valve linear with parallel margins and rostrate ends. Striae oblique, 24 to 28 in 0.01 mm. Axial area narrow. Central area broad. Length, 0.34 mm, breadth, 0.0062. Differs from variety *parva* Mereschk. and variety *hankensis* Sak. in its rostrate ends and its size.

NEIDIUM OBLIQUE-STRIAM A. S. var. NIPPONICA var. nov. Plate 4, figs. 5 and 21.

Valve lanceolate with attenuate ends. Striae oblique, 16 to 17 in 0.01 mm. Length, 0.096 to 0.1 mm, breadth, 0.02 to 0.025. This new variety resembles *Neidium* sp. in A. Schmidt, Atlas Diatom pl. 49, fig. 1, and *Neidium affine* var. *amphirhynchus* Ehr. fo. *maxima* Cleve, Navicul. Diatom. 69.

NEIDIUM OBLIQUE-STRIAM A. S. var. ROSTRATA var. nov. Plate 4, fig. 16.

Valve with rostrate ends. Striae oblique, 24 in 0.01 mm. Length, 0.061 mm, breadth, 0.015. Differs from the type in its rostrate ends.

NEIDIUM OBLIQUE-STRIAM A. S. var. APICULATA var. nov. Plate 4, fig. 24.

Valve lanceolate with obtuse and apiculate ends. Length, 0.044 mm, breadth, 0.012. Striae oblique, 14 in 0.01 mm. Not common.

DIPLODENS OVALIS (Hise) Cleve. Plate 7, fig. 27.

Diploëns ovalis (Hise) Cleve. FR. HUSTEDT, Bac. Lar. 1930, 249, fig. 390.

Valve elliptic with broad and rounded ends. Length, 0.028 to 0.03 mm, breadth, 0.013 to 0.015. Central nodule large rounded. Transverse rows of alveoli, 10 to 10 in 0.01 mm, radiate at ends. Puncta 14 in 0.01 mm. Common in fresh water. Reported from Nippon. According to Fr. Hustedt, the Nippon forms of *Diploëns ovalis* are always large with double rows of alveoli. Such forms I find it desirable to separate.

DIPLODENS OVALIS (Hise) Cleve var. *OBLONGELLA* (Nagae) Cleve. Plate 2, fig. 26.

Diploëns ovalis (Hise) Cleve var. *oblongella* (Nagae) Cleve. FR. HUSTEDT, Bac. Lar. 1930, 243, fig. 391.

Valve near-elliptic. Length, 0.041 to 0.046 mm, breadth, 0.013 to 0.017. Rows of alveoli, 10 to 11 in 0.01 mm. Very common at Kizaki Lake. Known from Aokiko Lake.

DIPLONEIS FCELLA (Schum.) Cleve. Plate 2, fig. 2.

Valve elliptic. Length, 0.023 mm; breadth, 0.012. Central nodule quadrate. Furrows narrow. Costae 12 to 13 in 0.01 mm. Alveoli indistinct. Known from fresh and brackish waters.

DIPLONEIS MARGINESTRATA Hustedt. Plate 12, fig. 9.

Diploneis marginestrata HUSTEDT, Bacillar. (1936) 250, fig. 387.

Valve elongate-elliptic with broad ends. Length, 0.032 mm; breadth, 0.01. Central nodule quadrate. Furrow broad, linear. Costae 21 in 0.01 mm, radiate at the ends. Known from alpine lakes in Europe. Reported from Aokiko Lake, Nippon.

DIPLONEIS SMITHII (Breb.) Cleve var. *NIPPONICA* var. nov. Plate 2, figs. 3 and 4.

Valve elliptic. Length, 0.068 to 0.1 mm; breadth, 0.03 to 0.047. Central nodule quadrate. Terminal nodules distant from the ends. Furrows broad, inclosing a space one-fourth as broad as the valve. Costae 5 to 6 in 0.01 mm, with double rows of alveoli, forming oblique lines. Differs from the type by its more elongate and attenuate ends. Very common in Kizaki Lake. The typical *Diploneis Smithii* is known as a brackish-water species.

DIPLONEIS SMITHII (Breb.) Cleve var. *OBELONGUELLA* var. nov. Plate 3, fig. 1.

Valve elongate-elliptic with broad ends. Length, 0.098 to 0.1 mm; breadth, 0.035 to 0.039. Central nodule quadrate. Furrow broad-lanceolate, inclosing a space one-third as broad as the valve. Costae 6 in 0.01 mm, with a double row of alveoli. Common in Kizaki Lake.

DIPLONEIS OCULATA (Breb.) Cleve. Plate 2, fig. 4.

Diploneis oculata (Breb.) Cleve, Fr. HUSTEDT, Bacillar. (1936) 250, fig. 392.

Valve elongate-elliptic. Length, 0.024 mm; breadth, 0.0076. Central nodule quadrate. Furrows linear. Costae 24 in 0.01 mm. Reported from Aokiko Lake.

DIPLONEIS OCULATA (Breb.) Cleve var. *NIPPONICA* var. nov. Plate 4, fig. 2.

Valve minute, elliptic with attenuated and rounded ends. Striae fine, marginal, 18 in 0.01 mm. Length, 0.012 mm; breadth 0.006. Lateral area hyaline. Central nodule quadrate. Furrow linear, interrupted in the middle part. *Diploneis oculata* is reported from Aokiko Lake.

DIPLOEIS ELLIPTICA (Kütz.) Cleve var. *LADOCENSIS* Cleve. Plate 2 figs. 7 and 8.
Diploëis elliptica (Kütz.) Cleve var. *ladocensis* CLEVE, *Unatom. Finland* (1893) 43, pl. 2 fig. 9

Valve elliptic. Length, 0.027 to 0.035 mm breadth 0.015 to 0.023. Transverse costæ irregularly anastomosing with a few longitudinal, undulating costæ. Known from Europe

STAUROEIS PHOENICENTERON Ehr. Plate 5, fig. 19.

Stauroëis phoenicenteron Ehr. FR. HUSTEDT, *Bacillar* (1930) 255, fig. 404.

Valve lanceolate with attenuate ends. Length 0.15 mm, breadth, 0.028. Striae 14 in 0.01 mm. Common in fresh water

STAUROEIS PHOENICENTERON Ehr. fo. *NIPTONICA* fo. nov. Plate 3, fig. 21. Plate 5, fig. 4.

Valve lanceolate broad with acute ends. Striae radial and somewhat curved 14 to 18 in 0.01 mm. Length, 0.085 to 0.11 mm, breadth, 0.024 to 0.025. Differs from the type in its short valve

STAUROEIS ANCEPS Ehr. Plate 5, fig. 22.

Stauroëis anceps Ehr. FR. HUSTEDT, *Bacillar* (1930) 256, fig. 405

Valve lanceolate with attenuate ends. Striae 18 in 0.01 mm. Length, 0.049 to 0.085 mm, breadth 0.011 to 0.02. Common in fresh water

STAUROEIS ANCEPS Ehr. fo. *GRACILIS* Ehr. Cleve. Plate 5, fig. 24.

Stauroëis anceps Ehr. fo. *gracilis* (Ehr.) Cleve. FR. HUSTEDT *Bacillar* (1930), 256, fig. 406.

Valve with long capitate ends. Length, 0.08 mm, breadth 0.013. Striae 15 in 0.01 mm. Rare

STAUROEIS ANCEPS Ehr. var. *LINEARIS* Ehr. Cleve. Plate 5 fig. 14.

Stauroëis anceps Ehr. var. *linearis* (Ehr.) Cleve. FR. HUSTEDT *Bacillar* (1930) 256, fig. 407

Valve linear with rostrate ends. Length 0.013 mm, breadth, 0.0085. Striae 24 in 0.01 mm. Uncommon.

STAUROEIS SMITHII Grun. Plate 3 fig. 1.

Stauroëis Smithii Grun. FR. HUSTEDT, *Bacillar* (1930) 261 fig. 420

Valve lanceolate, constricted in the middle part, rostrate at the ends. Central area a short fascia. Length, 0.046 mm, breadth 0.0042. Common in fresh water

STAUROEIS SMITHII Grun. var. *INCISA* Pantocsek. Plate 4, fig. 27

Stauroëis Smithii Grun. var. *incisa* Pantocsek, FR. HUSTEDT *Bacillar* (1930) 261 fig. 421

Valve lanceolate, attenuate with long ends. Length, 0.03 mm, breadth, 0.008. Striae 2 in 0.01 mm. Rare.

STAIKONIA SMITHII Grun. var. NIPPONICA var. nov. Plate 10, fig. 7.

Valve slightly tri-angulate. Ends long, acuminate. Length, 0.034 mm, breadth, 0.0068. Striae 28 to 30 in 0.01 mm. Differs from variety *smithii* in its undulate margins.

ANOMONEIS BILBIS Kütz. Cleve var. NIPPONICA var. nov. Plate 11, fig. 16.

Valve sublinear-lanceolate, asymmetrical convex, with attenuated, obtuse ends. Length, 0.044 mm; breadth, 0.0051. Striae indistinctly punctate, striolate 18 to 20 in 0.01 mm. Not common in Kizak, Lake.

NAVICULA CUSPIDATA Kütz. Plate 6, fig. 14.

Navicula cuspidata Kütz., Fr. HUSTEDT, Mac Har (1930) 268, fig. 435.

Valve lanceolate, acute. Striae parallel, 15 in 0.01 mm. Length, 0.096 mm, breadth, 0.022. Uncommon.

NAVICULA HOLOPHILA (Grun.) Cleve (n. MINOR Kütz. Plate 4, fig. 18.

Navicula holophila (Grun.) Cleve (n. minor Kütz. Kriegerhagen des Sporenberger Salzgebiete, 1927, p. 1, fig. 4.

Valve lanceolate, acute. Striae fine, slightly radiate; transverse striae 18, longitudinal 30 in 0.01 mm. Axial area narrow. Length, 0.082 mm; breadth, 0.017. Known from brackish water in Europe.

NAVICULA LAPIDOSA Grunke var. NIPPONICA var. nov. Plate 6, fig. 12.

Valve elliptical. Striae radiate, 18 to 19 in 0.01 mm. Central area a broad stauros, widened and truncate outwards. Axial area very narrow. Length, 0.015 mm; breadth, 0.0085. *Navicula lapidosa* is known from Europe.

NAVICULA ROTUNDA Rabb. Grun. Plate 6, fig. 23.

Navicula rotunda (Rabb.) Grun. Fr. HUSTEDT, Baelliar (1930) 271, fig. 445.

Valve elliptic, rounded. Striae fine, 20 to 25 in 0.01 mm. Central area a broad stauros. Length, 0.015 mm, breadth, 0.0085. An alpine species.

NAVICULA MUTICA Kütz. Plate 13, fig. 5.

Navicula mutica Kütz., Fr. HUSTEDT, Mac Har (1930) 274, fig. 433a.

Valve elliptic-lanceolate. Striae distinctly punctate, 20 in 0.01 mm. Central area with an isolated punctum. Length, 0.022 mm; breadth, 0.0085. Common in fresh water.

NAVICULA PERSICILLA Grun. Plate 3, fig. 6.

Navicula persicilla Grun., FR. H. STEDT Bac. Ar. (1930) 278, fig. 459

Valve nearly elliptic. Striae very fine 50 in 0.01 mm. Axial area broad. Length, 0.01 mm. breadth, 0.0042. Uncommon in Kizaki Lake.

NAVICULA CONFUSAE Kütz. fo. NIPPONICA fo. nov. Plate 3, fig. 7. Plate 4, fig. 23.

Valve elliptic, attenuate at the ends. Striae radiate, marginal, 15 to 16 in 0.01 mm. Axial and central areas broad-lanceolate. Length, 0.014 to 0.015 mm, breadth, 0.0068 to 0.007. *Navicula confusae* is common in de Tromps.

NAVICULA AMERICANA Ehr. Plate 3, fig. 23.

Navicula americana Ehr., FR. H. STEDT Bac. Ar. (1930) 280, fig. 464.

Valve linear elliptic. Length, 0.068 mm, breadth, 0.02. Striae 15 in 0.01 mm. Not common in Kizaki Lake.

NAVICULA LAMBDA Cleve var. DENSISTRIATA var. nov. Plate 4, fig. 5.

Valve linear. Striae in the middle part of the valve 24 in the ends about 30, in 0.01 mm. Length, 0.43 mm, breadth, 0.0085. The Nippon variety differs from the type in its close striae. *Navicula Lambda* is known from Demerara River, South America.

NAVICULA PIPULA Kütz. Plate 4, fig. 15.

Navicula pipula Kütz. var. *rectangularis* (Cleve) Grun. FR. HUSTEDT Bac. Ar. (1930) 28, fig. 467b.

Valve linear. Length, 0.039 mm, breadth, 0.008. Striae 24 in 0.01 mm. Common.

NAVICULA PIPULA Kütz. var. CAPITATA Husted. Plate 4, fig. 16.

Navicula pipula Kütz. var. *capitata* HUSTEDT Bac. Ar. (1930) 28, fig. 467c.

Valve weakly capitate ends. Striae 4 to 20 in 0.01 mm. Length, 0.013 to 0.028 mm. breadth, 0.004 to 0.006. Not common.

NAVICULA CRUCIATA W. Smith Donkin var. CAPITATA var. nov. Plate 5, fig.

Valve elliptic with capitate ends. Striae closer towards the ends, 15 to 16 in 0.01 mm. Axial area very narrow, somewhat widened in the middle part. Length, 0.02 mm. breadth, 0.006. Differs from the type in its capitate ends.

NAVICULA AQUEDUCTE Kraske fo. MINUS Kraske. Plate 5, fig. 16.

Navicula aqueducte Kraske fo. *minus* KRASKE. Bacillar Veget. Niederhessens (1925) 44 p. 2, fig. 93.

Valve slightly sinuately linear, constricted in the middle part, attenuate and capitate at the ends. Length, 0.014 mm, breadth 0.0028. Reported from Europe.

NAVICULA MURALIS Grun. Plate 5, fig. 11.

Navicula muralis Grun. FR. HUSTEDT, Bac. Lar. (1930) 288, fig. 48.

A minute elliptical valve with rounded ends. Striae in the middle 28 to 40 at the ends 40, in 0.01 mm. Common in fresh water.

NAVICULA ATOMARIUS sp. nov. Plate 5, fig. 3.

Valve linear, slightly convex and oblique. Length, 0.009 mm, breadth 0.0034. Striae very fine, about 40, in 0.01 mm. Central area round, axial area, near and narrow. Differs from *Navicula pellucida* by its enlarged central area.

NAVICULA ATOMARIUS (Chambr.) Grun. var. *NIPPONICA* var. nov. Plate 5, fig. 16.

Valve elliptical. Striae about 16 in the middle, 16 at the ends, 2 in 0.01 mm. Length 0.005 mm, breadth 0.0005. *Navicula atomarius* is smaller than the Nippon variety.

NAVICULA MURICOLA var. Plate 11, fig. 6.

Navicula muricola Grun, FR. HUSTEDT, Bac. Lar. (1930) 288, fig. 48.

Valve slightly siliceous, a coccolite. Length, 0.01 mm, breadth 0.003. Common.

NAVICULA PUSIO var. Plate 4, figs. 20 and 21. Plate 11, fig. 27.

Navicula PUSIO var. FR. HUSTEDT, Synops. of di. N. in Diatom. 1896, 2, pl. 2, fig. 3.

Valve elliptical with broad, radiate striae. Axial area very narrow, central area small. Striae fine, radiate, about 25 to 30 in 0.01 mm, closer toward the ends. Length, 0.014 to 0.18 mm, breadth 0.000 to 0.008. Reported from Rotorua Lake, New Zealand and from Aomori Lake, Nippon.

NAVICULA PUSIO var. *ARCUATA* Pantocsek, Skovorzon, Plate 2, fig. 35.

Navicula arcuata PANTOCSEK, Moss. Ruef. J. ungar. 1903, 3, pl. 6, fig. 97.

Valve larger than the type. Striae very fine. Axial area narrow, widened in the middle. Length, 0.027 mm, breadth 0.015. The type *Navicula arcuata* has radiate striae.

NAVICULA PSEUDOSCIPTIFORMIS Husted. Plate 4, fig. 15.

Navicula pseudoscriptiformis HUSTEDT, Bac. Lar. 1930, 291, fig. 495.

Valve broad elliptical, about circular. Striae radiate, 18 in 0.01 mm. Length 0.0085 mm, breadth 0.007. Known from Europe.

NAVICULA CRYPTOCEPHALA Kütz. Plate 16, fig. 3.

Navicula cryptocephala Kütz., FR. HUSTEDT, Bacillar. 1930: 295, fig. 496.

Valve lanceolate, attenuate. Striae radiate, 18 in 0.01 mm. Length, 0.02 mm; breadth, 0.005. Common in fresh water.

NAVICULA CRYPTOCEPHALA Kütz. var. **VENETA** (Kütz.) Grun. Plate 7, fig. 1.

Navicula cryptocephala Kütz. var. *veneta* (Kütz.) Grun. FR. HUSTEDT, Bacillar. (1930) 295, fig. 497a.

Valve lanceolate, attenuate. Striae radiate, 13 to 14 in 0.01 mm. Axial area narrow. Length, 0.023 mm; breadth, 0.005. Common in fresh water.

NAVICULA SALINARUM Grun. var. **NIPPONICA** var. nov. Plate 3, fig. 21.

Valve lanceolate, elliptical and acuminate. Striae robust, 9 in 0.01 mm, in the middle of unequal length. Length, 0.03 mm; breadth, 0.0085. The typical *Navicula salinarum* has the striae 14 to 16 in 0.01 mm and is known from brackish water.

NAVICULA RHYNCHOCEPHALA Kütz. Plate 3, fig. 2.

Navicula rhychocephala Kütz., FR. HUSTEDT, Bacillar. (1930) 296, fig. 501.

Valve lanceolate with attenuate ends. Striae radiate, 12 to 13 in 0.01 mm. Axial area narrow. Length, 0.035 mm; breadth, 0.0085. Reported from many parts of the world.

NAVICULA ROSTELLATA Kütz. Plate 5, fig. 1.

Navicula rostellata Kütz., A. SCHMIDT, Atlas Diatom. pl. 47, figs. 27-30.

Valve lanceolate with attenuate ends. Striae radiate in the middle, of unequal length, 11 in 0.01 mm. Length, 0.035 mm; breadth, 0.0076. Known from Nippon.

NAVICULA ROSTELLATA Kütz. var. **NIPPONICA** var. nov. Plate 3, fig. 22.

Valve more attenuate with slightly capitate ends. Striae 9 to 10 in 0.01 mm. Length, 0.028 mm; breadth, 0.006. Differs from the type in its margins and capitate ends. Uncommon.

NAVICULA RADIOSA Kütz. Plate 5, fig. 2.

Navicula radiosa Kütz., FR. HUSTEDT, Bacillar. (1930) 299, fig. 513.

Valve narrow-lanceolate, acuminate. Striae 9 in 0.01 mm. Length, 0.072 mm; breadth, 0.01. Common in fresh water.

NAVICULA MENISCULUS Schumann. Plate 3, fig. 16.

Navicula menisculus Schumann, FR. HUSTEDT, Bacillar. 1930: 301, fig. 517.

Valve lanceolate, broad. Striae distinct, not lineolate, 9 in 0.01 mm of unequal length in the middle. Central area broad. Length 0.015 mm, breadth 0.013. Common.

NAVICULA GLOBULIFERA Husted. Plate 3, fig. 6.

Navicula globulifera Husted. Bac. et. Mus. dem. Mikoskee in Japan 164 p. 5, fig. 7.

Valve lanceolate with capitate ends. Striae divergent in the middle convergent at the ends. The middle striae 8 to the end striae 14, in 0.01 mm. Length 0.068 mm, breadth 0.010, known from Nippon.

NAVICULA GLOBULIFERA Husted var. NIPPONICA var. nov. Plate 3, fig. 10.

Valve more elongate with roscapitate ends. Striae 12 in 0.01 mm. Length, 0.083 mm, breadth 0.01. Differs from the type in its attenuate and noncapitate ends.

NAVICULA PALATSIENSIS Grun. var. LANCEOLA Grun. Plate 4, fig. 9.

Navicula palatziensis Grun. var. *lanceola* Grun. FR. HUSTED Bot. Far. 1939 402, fig. 524.

Valve, near-lanceolate with rounded and roscapitate ends. Striae fine, radiate 18 to 22 in 0.01 mm. Axial area very narrow. Central area small. Length, 0.017 mm, breadth 0.005. Reported from slightly brackish and fresh waters.

NAVICULA PALATSIENSIS Grun. var. NIPPONICA var. nov. Plate 4, fig. 15.

Valve lanceolate, rostrate. Striae fine, slightly radiate, 18 in 0.01 mm. Axial area very narrow. Differs from the type in its subrostrate or rostrate ends and different number of striae.

NAVICULA DIPHYLLA (Ehr.) W. Smith. Plate 3, fig. 4.

Navicula diphylla (Ehr.) W. Smith, FR. HUSTED Bot. Far. 1930 302, fig. 525.

Valve near-lanceolate with rostrate ends. Striae radiate, 11 in 0.01 mm. Length 0.052 mm, breadth, 0.012. Common.

NAVICULA EXIMA Grun. O. Mull. Plate 4, fig. 9.

Navicula exima Grun. O. M. L., FR. HUSTED Bot. Far. 1920 365, fig. 538.

Valve near lanceolate with capitate ends. Striae 16 in 0.01 mm. Length 0.017 mm, breadth, 0.005. A fresh water diatom.

NAVICULA SIMILIS Krasske. Plate 4, fig. 13.

Navicula similis Krasske FR. HUSTED Bot. Far. 1930 304, fig. 528.

Valve minute, lanceolate with acute ends. Striae distinct 14 in 0.01 mm. Axial and central areas narrow. Length 0.01 mm, breadth 0.005. Reported from Europe.

NAVICULA ANGULICA Ralfs. Plate 5, fig. 18.

Navicula anglica Ralfs. FR. HUSTEDT Bacillar (1930) 303, figs. 530-531

Valve elliptic with rostrate ends. Striae slightly radiate, 12 to 13 in 0.01 mm. Axial area narrow, widened in the middle part. Length 0.022 mm, breadth 0.008. Common in fresh water.

NAVICULA PLACENTULA (Ehr.) Grun. fo. ROSTRATA A. Mayer. Plate 6, fig. 5.

Navicula placentula (Ehr.) Grun. fo. *rostrata* A. Mayer. FR. HUSTEDT Bacillar (1930) 304, fig. 533.

Valve elliptic-lanceolate with rostrate ends. Striae robust, 7 in 0.01 mm. Length, 0.062 mm, breadth 0.023. Reported from Europe, Siberia, New Zealand, and America.

NAVICULA PLACENTULA (Ehr.) Grun. fo. NIPPONICA fo. nov. Plate 10, fig. 28.

Valve robust, short-lanceolate with rostrate ends. Striae 12 in 0.01 mm. Length 0.024 mm, breadth 0.012. This form differs from form *rostrata* Mayer in its shorter valve.

NAVICULA LANCEOLATA (Agardh) Kütz. Plate 5, fig. 4. Plate 6, fig. 6.

Navicula lanceolata (Agardh) Kütz. FR. HUSTEDT Bacillar (1930) 305, fig. 540.

Valve lanceolate, acuminate. Striae lineolate 9 to 12 in 0.01 mm. Length 0.059 to 0.06 mm, breadth 0.0085 to 0.01. Known from Nippon.

NAVICULA LANCEOLATA Agardh. Kütz. var. CYMBELLA Donk. Cleave. Plate 5, fig. 17.

Navicula lanceolata Agardh) Kütz. var. *cymbella* Donk. Cleave. VAN HEURCK Synopsis p. 7 fig. 32.

Valve lanceolate, acuminate. Striae radiate, lineate, widened in the middle 5 at the ends 8 in 0.01 mm. Length 0.085 mm, breadth 0.013. Reported from Nippon.

NAVICULA HASTA Pantocsek. Plate 5, fig. 1.

Navicula hasta PANTOCSEK. FOSS. Diatom. Ungarn (1903) 3, p. 5, fig. 7, pl. 14, fig. 213.

Valve lanceolate with attenuate, not cuneate rounded ends. Striae lineate, robust 7 to 8 in 0.01 mm, radiate, widened in the middle part. Length 0.096 mm, breadth, 0.017. Our specimens are different from the forms described by Fr. Meister from No. 11 and Sava Lakes in Nippon.

NAVICULA PEREGRINA Ehr. Kütz. var. CUNEATA var. nov. Plate 5, fig. 24.

Valve lanceolate, broad with cuneate ends. Striae radiate, divergent at the ends 9 in 0.01 mm. Length, 0.049 mm.

breadth, 0.0045. Differs from the type in its broad valve and its ends.

NAVICULA LACUSTRIS Grun. Plate 3, fig. 6; Plate 4, fig. 3

Navicula lacustris (Grun.) Cleve, *Diatoms Finland* (1893) 24, pl. 2, figs. 7, 12, 14

Valve elliptical and acuminate. Striae punctate. Length, 0.02 to 0.044 mm; breadth, 0.01 to 0.015. Striae 16 in 0.01 mm. Reported from Europe, Asia, and America.

NAVICULA AMPHIBOLA Cleve. Plate 4, fig. 20.

Navicula amphibola (Cleve) F. J. Hustedt, *Macillae* (1930) 309-310, fig. 554.

Valve lanceolate with attenuate ends. Striae punctate, 12 in 0.01 mm. Length, 0.047 mm; breadth, 0.017. Not common in Kizaki Lake.

NAVICULA PATEA sp. nov. Plate 4, fig. 4.

Valve linear, lanceolate, narrow-attenuate with slightly capitate ends. Striae fine, radiate, 15 to 16 in 0.01 mm. Axial and central areas narrow and linear. Length, 0.029 mm; breadth, 0.0037. Differs from *Navicula radiosa*, *N. curv.* and *N. cincta* in its narrow central area and capitate ends.

NAVICULA KIZAKENSES sp. nov. Plate 14, fig. 12.

Valve minute, lanceolate, rounded in the middle, attenuate and capitate at the ends. Striae radiate, about 30 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.011 mm; breadth, 0.0042. Differs from *Navicula Schadei* Kriesske¹ in its narrow central area and coarser striae.

NAVICULA BRENNI Huston f. *ELONGATA* f. nov. Plate 3, fig. 2.

Valve linear-elliptic with parallel margins and cuneate ends. Striae parallel, coarse, 18 to 20 in 0.01 mm. Axial area narrow, linear, widened in the middle part. Length, 0.032 mm; breadth 0.0068. Differs from the type in its longer valves. The type is reported from Aokiko Lake, Nippon.

PINNULARIA LEPTOROMA Grun. Plate 4, fig. 8.

Pinnularia leptoroma Grun., F. J. Hustedt, *Macillae* (1930) 316, fig. 567.

Valve linear, narrowed towards the ends. Striae radiate, 16 in 0.01 mm. Length, 0.032 mm; breadth, 0.005. A fresh-water species, especially of alpine regions.

¹ Beiträge zur Kenntnis der Diatomeenflora Sachsens (1929) 356, fig. 1a, b.

PINNULARIA LEPTOSOMA Grun. var. *NIIPPONICA* var. nov. Plate 8, fig. 15.

Valve linear, attenuate. Striae fine, 14 in 0.01 mm. Axial area narrow, central area a broad fascia. Length, 0.066 mm; breadth, 0.0068. Differs from the type in its longer valves.

PINNULARIA MOLARIS Grun. Plate 6, fig. 13.

Pinnularia molaris Grun., FR. HUSTEDT, Bacillar (1930) 316, fig. 568.

Valve minute, lanceolate, with radiate striae 18 in 0.01 mm. Length, 0.025 mm; breadth, 0.005. Common in fresh water.

PINNULARIA NISOLEPTA (Ehr.) W. Smith. Plate 2, fig. 19; Plate 12, fig. 11.

Pinnularia niolepta (Ehr.) W. Smith., FR. HUSTEDT, Bacillar (1930) 319, fig. 575.

Valve triundulate with capitate ends. Striae radiate, 10 to 12 in 0.01 mm. Length, 0.022 mm; breadth, 0.006 to 0.012. Common.

PINNULARIA DIVERGENTISSIMA Grun. Plate 12, fig. 71.

Pinnularia divergentissima Grun., VAN HEURCK, Synops. (1880-1881) pl. 6, fig. 32.

Valve linear, attenuate towards the ends. Striae strong, radiate, 15 in 0.01 mm, with a broad fascia. Length, 0.047 mm; breadth, 0.0068. Uncommon.

PINNULARIA MICROSTACHYON (Ehr.) Cleve. Plate 7, fig. 6.

Pinnularia microstachyon (Ehr.) Cleve, FR. HUSTEDT, Bacillar (1930) 320, fig. 582.

Valve linear-lanceolate with parallel margins and rounded subrostrate ends. Striae radiate, 10 in 0.01 mm. Length, 0.056 mm; breadth, 0.01. Common.

PINNULARIA MICROSTACHYON (Ehr.) Cleve var. *AMBIGUA* Webster fo. *MINUTA* Grun. Plate 7, fig. 15.

Pinnularia microstachyon (Ehr.) Cleve var. *ambigua* Webster fo. *diminuta* Grun., FR. HUSTEDT, Bacillar (1930) 321-322, fig. 585.

Valve lanceolate. Striae radiate, 14 in 0.01 mm. Length, 0.03 mm; breadth, 0.006. Common in fresh water.

PINNULARIA MICROSTACHYON (Ehr.) Cleve var. *NIIPPONICA* var. nov. Plate 6, fig. 8; Plate 9, fig. 10.

Valve undulate with obtuse ends. Striae 10 to 11 in 0.01 mm. Length, 0.045 to 0.056 mm; breadth, 0.0035 to 0.011. Differs from the type in its broad obtuse ends.

PINNULARIA MICROSTACHYON (Ehr.) Cleve var. *KIZAKENSE* var. nov. Plate 6, fig.

Valve with parallel margins and attenuate ends. Striae robust, 9 to 13 in 0.01 mm. Central area a broad fascia. Length

0.034 to 0.062 mm, breadth, 0.0093 to 0.013. Differs from the type in its attenuate ends. Common in Kizak Lake.

PINNULARIA KARELICA Cleve var. *JAPONICA* Hustedt. Plate 4, fig. 4.

Pinnularia karelica Cleve var. *japonica* HUSTEDT Bacill. d. Aoki-kosee in Japan 166, pl. 5, fig. 3.

A distinct form with slightly capitate ends. Striae 14 in 0.01 mm, crossed by a band. Length, 0.031 mm; breadth, 0.012. Known from Aokiko Lake.

PINNULARIA KARELICA Cleve var. *JAPONICA* Hustedt fo. *OBTUSA* fo. nov. Plate 4, fig. 2.

A small obtuse form, with striae 12 to 13 in 0.01 mm, with narrow axial area. Length, 0.044 mm; breadth, 0.013. Uncommon.

PINNULARIA KARELICA Cleve var. *INSULAE* var. nov. Plate 4, fig. 11.

Valve linear with capitate ends. Striae 8 to 9 in 0.01 mm, crossed by a narrow band. Central area elliptical. Differs from variety *japonica* Hustedt in its broad axial area and larger valve.

PINNULARIA LEGUMEN Ehr. Plate 5, fig. 6.

Pinnularia legumen Ehr., FR. HUSTEDT Bacill. (1930) 322, fig. 567.

Valve strongly triundulate with capitate ends. Striae 8 in 0.01 mm. Length, 0.088 mm, breadth 0.014. Reported from Nippon.

PINNULARIA LEGUMEN Ehr. var. *JAPONICA* var. nov. Plate 7, fig. 4.

Valve with slightly undulate margins. Striae 10 in 0.01 mm. Length, 0.078 mm; breadth, 0.015. Differs from the type in its broader and more obtuse valve.

PINNULARIA PLATYCEPHALA (Ehr.) Cleve. Plate 6, fig. 1.

Pinnularia platycephala (Ehr.) Cleve, FR. HUSTEDT Bacill. (1930) 324, fig. 593.

A robust species with triundulate margins. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.09 mm, breadth, 0.019. Common in lakes.

PINNULARIA PLATYCEPHALA (Ehr.) Cleve var. *HATTORIANA* Meister. Plate 6, fig. 2.

Pinnularia platycephala (Ehr.) Cleve var. *Hattorianae* MEISTER, Beitr. z. Bacill. Japan (1914) 2, 228-229 pl. 8, figs. 6, 7.

A distinct diatom with capitate ends and large comma-shaped terminal fissures. Length, 0.079 mm; breadth, 0.01. Striae 8 in 0.01 mm. This diatom was named by Dr. Fr. Meister in

honor of D. Hattori, of the Botanical Institute, Imperial University, Tokyo.

PINNULARIA MONTANA Hattori *fo. MEXOR* *fo. nov.* Plate 9, fig. 9

Valve lanceolate. Striae short, 8 to 9 in 0.01 mm. Length 0.051 to 0.068 mm, breadth, 0.012 to 0.015. Longitudinal band indistinct. The typical *Pinnularia montana* was described from Aokiko Lake and is twice as large (length, 0.12 to 0.15 mm)

PINNULARIA BREVIROSTRATA Cleve. Plate 12, fig. 1.

Pinnularia montana Husted. var. *sinica* SKIFFERTON. A procladon of South China (1929) 43, pl. 2, fig. 14, pl. 3, fig. 13.

Valve linear with obtuse ends. Striae parallel, with a longitudinal band, 10 to 11 in 0.01 mm. Length, 0.105 mm, breadth, 0.017. Reported from Foochow, southern China

PINNULARIA GIBBA Ehr. Plate 7, figs. 2 and 3.

Pinnularia gibba Ehr., FR. HUSTEDT, Bacillar (1930) 327 fig. 600a, b.

Valve lanceolate with capitate ends. Central area a broad fascia. Length, 0.066 to 0.068 mm; breadth, 0.008 to 0.01. Striae 9 to 11 in 0.01 mm. Common in fresh water

PINNULARIA GIBBA Ehr. *fo. SUBUNDULATA* Mayer. Plate 7, fig. 15.

Pinnularia gibba Ehr. *fo. subundulata* Mayer, FR. HUSTEDT, Bacillar (1930) 327, fig. 601.

Valve slightly triundulate with rostrate, minutely capitate ends. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. Length, 0.069 mm; breadth, 0.01. Common.

PINNULARIA GIBBA Ehr. var. *NIIPPONICA* var. nov. Plate 7, fig. 14.

Valve slightly triundulate, ends little capitate. Striae radiate, 12 in 0.01 mm. Central area round. Length, 0.095 mm breadth, 0.013. Differs from the type in its triundulate margins

PINNULARIA OKAMURA sp. nov. Plate 7, fig. 13.

Valve linear with attenuate ends. Striae divergent in the middle part, convergent at the ends, 11 to 12 in 0.01 mm. Length, 0.061 mm; breadth, 0.008. A species related to *Pinnularia gibba* var. *linearis* Husted. Named in honor of the late Prof. Dr. K. Okamura, director of the Imperial Fisheries Institute, Tokyo.

PINNULARIA BOREALIS Ehr. Plate 7, fig. 17; Plate 16, fig. 15.

Pinnularia borealis Ehr., FR. HUSTEDT, Bacillar (1930) 326 fig. 595

Valve linear-elliptic with rounded ends. Striae radiate, 6 to 7 in 0.01 mm. Length, 0.027 mm; breadth, 0.0068 to 0.009. Com

mon on mosses, moist earth, and in fresh water. Known from Nippon.

PINNULARIA HAIPHONGIANA Grun. var. *STALHOPTERA* var. nov. Plate 16, fig. 16.

A minute form with radiate striae, 9 to 10 in 0.01 mm, which form a stauros in the middle part of the valve. Length, 0.017 mm; breadth, 0.005. Rare. Differs from the type in its larger size and a stauros in the middle part of the valve.

PINNULARIA LIGNITICA Cleve. Plate 19, fig. 25.

Pinnularia lignitica CLEVE. Synopsis Navicul. Diatoms (1895) 2, 86, pl. 1, fig. 15.

A distinct species with rhombic valve, short striae 11 to 12 in 0.01 mm, and a broad central area. Length, 0.062 mm; breadth, 0.018. Longitudinal band distinct. Common in Kizaki Lake. Reported as a fossil from Nippon lignite (Brun collection).

PINNULARIA TABELLARIA Ehr. Plate 6, fig. 5.

Pinnularia tabellaria Ehr., A. SCHMIDT, Atlas Diatom, pl. 43, fig. 4.

Valve linear, slightly gibbous in the middle. Striae parallel, convergent at the ends, 10 in 0.01 mm. Axial area linear, central area elliptic. Length, 0.244 mm; breadth, 0.019. Known from North America, Brazil, Siberia, and South Africa.

PINNULARIA HUSTEDTI Husted. Plate 8, fig. 3.

Pinnularia Hustedti HUSTEDT, Schöne und seltene Kieselalgen (1934) 102, fig. 52.

Valve linear with capitate ends. Axial area linear, widened in the middle. Striae 9 in 0.01 mm. Length, 0.221 mm; breadth, 0.017. Reported only from Canton River, southern China.

PINNULARIA MAJOR (Kütz.) Cleve. Plate 6, fig. 10.

Pinnularia major (Kütz.) CLEVE. FR. HUSTEDT, Bacillar (1930) 331, fig. 4.

Valve linear, slightly gibbous in the middle. Length, 0.161 mm; breadth, 0.022. Striae 7 in 0.01 mm. Common in fresh water. Known from Nippon.

PINNULARIA MAJOR (Kütz.) Cleve var. *LINEARIS* Cleve. Plate 2, fig. 11.

Pinnularia major (Kütz.) CLEVE var. *linearis* CLEVE, PANJOSSEK, Festschr. Bacillarien Ungarns (1905) 5, pl. 2, fig. 113.

Valve broad-linear with parallel margins. Striae 9 in 0.01 mm. Length, 0.127 mm; breadth, 0.02. Common.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. LEPTOGONGYLA Ehr. Grun. Cleve. Plate 6, fig. 1.

Pinnularia leptogongyla A. SCHMIDT. Atlas Diatom. (1876) p. 45. figs. 26-28.

Valve linear with attenuate ends. Striae 7 to 8.5 in 0.01 mm. with a distinct band. Central area broad axial area one-third of the breadth of the valve. Known from brackish waters of Europe.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. INTERMEDIA Cleve. Plate 7, fig. 2.

Pinnularia sp. A. SCHMIDT. Atlas Diatom. (1876), p. 42. figs. 9-10.

Valve large with two longitudinal bands. Central area broad. Length, 0.105 mm., breadth 0.017. Striae 8 to 11 in 0.01 mm. Common in fresh water.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. FALLAX Cleve. Plate 9, fig. 7. Plate 13, fig. 18.

Noecula sp. A. SCHMIDT, Atlas Diatom. (1876) pl. 43, fig. 24. pl. 46, figs. 10-11.

Valve linear, narrowed towards the ends. Striae 9 to 11 in 0.01 mm. without longitudinal band. Central area with a short striae or shortened striae. Length, 0.045 to 0.040 mm. breadth 0.01. Common.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. SUDETICA Hise? Hustert. Plate 9, fig. 2.

Pinnularia viridis (Nitzsch) Ehr. var. *sudetica*. Hise? HUSTERT. Lacular. (1930) 335 fig. 6.7b.

A form with coarse striae, 9 in 0.01 mm., with a longitudinal band. Axial and central areas linear. Known from fresh water in Europe.

PINNULARIA VIRIDIS (Nitzsch) Ehr. var. NIPPONICA var. nov. Plate 6, fig. 14. Plate 8, fig. 2.

Valve lanceolate with complex median line. Striae 6 to 7.5 in 0.01 mm. Length, 0.081 to 0.09 mm. breadth, 0.018. This new variety differs from the type in its striae without the longitudinal band. Common in Kizaki Lake.

PINNULARIA UENO sp. nov. Plate 7, fig. 1.

Valve boat-shaped, elliptic-lanceolate with parallel margins and obtuse subrostrate ends. Striae robust radiate distal in the middle to a transverse fascia, 9 in 0.01 mm. Median line slightly arcuate. Terminal fissures comma-shaped. Axial area somewhat dilated in the middle. Central pores distinct. Length, 0.062 mm., breadth, 0.013. Named in honor of Dr. Masajo Ueno, of Otsu, Nippon.

PINNULARIA NIPPONICA sp. nov. Plate 7, fig. 12.

Valve slightly triundulate, with truncate ends. Striae robust, radiate 8 in 0.01 mm. Central area a fascia. Median line flexuose. Terminal fissures comma-shaped. Axial areas linear. Length, 0.072 mm; breadth, 0.013. Uncommon.

PINNULARIA DACTYLUS Ehr. var. **DARIANA** A. S. f. **NIPPONICA** f. nov. Plate 7, fig. 1.

Valve lanceolate with obtuse ends. Length, 0.122 mm. Breadth, 0.22. Median line not complex. Axial area broad, widened in the middle part. Striae divergent in the middle, convergent at the ends, 8 in 0.01 mm. The type form has the valve 0.18 to 0.21 mm in length with striae, crossed by a broad band. Variety *Dariana* is reported from America.

PINNULARIA NOBILIS Ehr. Plate 10, fig. 1.

Pinnularia nobilis Ehr., Fr. Hustedt, Bacillar (1920) 337, fig. 618.

Valve linear, slightly gibbous in the middle, with rounded ends. Length, 0.204 mm; breadth, 0.03. Striae 6 in 0.01 mm. Common.

PINNULARIA HARTLEYANA Grunth. Plate 8, fig. 2.

Pinnularia Hartleyana Grunth., Descriptions of new and rare diatoms T. M. S. 13 (1863) pl. 6, fig. 30, A. SCHMIDT Atlas Diatom. (1913) pl. 33 figs. 1, 2. O. B. DE TOXI and F. L. FORT, Alga di Australia, Tasmantia e Nuova Zelanda (1923) 145, fig. 6.

Valve robust undulate in the middle and on the ends. Length, 0.12 mm; breadth, 0.015. Ends cuneate. Striae divergent in the middle convergent at the ends, 9 in 0.01 mm. Central area a rectangular fascia. Axial area enlarged around the central nodule and expanded at the ends. The Nippon form is smaller than the type. *Pinnularia Hartleyana* has been reported from Liberia and Kainari in Africa, Demerara River in South America, Wakasuvareva in New Zealand, and Aokiko Lake in Nippon.

AMPHORA OVALIS Kütz. f. **GRACILIS** (Ehr.) Cleve. Plate 2, fig. 16.

Amphora sp. A. SCHMIDT, Atlas Diatom. (1875) pl. 26, fig. 101.

Frustule elliptic. Length, 0.02 mm; breadth, 0.0085. Striae 16 in 0.01 mm. Common in fresh water.

AMPHORA OVALIS Kütz. var. **PEDICULAR** Ehr. Plate 2, fig. 11.

Amphora ovalis Kütz. var. *pedicular* Kütz., Fr. Hustedt, Bacillar (1920) 343, fig. 622.

Frustule elliptic. Valve lunate. Length, 0.012 mm, breadth 0.0076. Striae 18 in 0.01 mm. Common in fresh and brackish waters. Known from Nippon.

AMPHORA OVALIS Kütz. var. *LIBYCA* (Ehr.) Kütz. Plate 3, fig. 7

Amphora libyca Ehr. A. SCHMIDT Atlas Diatom. 1875, p. 26, fig. 10.

Valve capitate. Length 0.035 mm, breadth, 0.0068. Striae 14 or 0.01 mm. Median line arcuate. Central area distinct, on the dorsal side frequently uniting with a black band across the striae. Common in fresh and brackish waters.

AMPHORA PERPUSILLA Grun. Plate 3, fig. 13.

Amphora perpallida Grun. FR. HUSTEDT Bac. Mar. (1880) 347, fig. 627.

Frustule elliptic. Length, 0.005 mm, breadth 0.0025. Common in fresh water and moist earth.

AMPHORA NORMANII Rabb. Plate 3, fig. 13.

Amphora Normanii Rabb. FR. HUSTEDT, Bac. Mar. (1880) 33, fig. 630.

Frustule elliptic, truncate. Valve narrow, linear, and capitate. Central nodule strong. Length, 0.024 mm; breadth, 0.0034. Striae 18 to 20 in 0.01 mm. Common in moist earth.

AMPHORA DELPHINIA Bailey & var. *MINOR* Grun. Plate 3, fig. 13.

Amphora delphinica Bailey, A. SCHMIDT Atlas Diatom. (1876), p. 40, fig. 11.

Frustule elliptic-rectangular with parallel margins. Length, 0.047 to 0.05 mm; breadth, 0.015. Valve linear with rounded ends. Central nodule dilated to a sinuosis. Median line arcuate. Striae almost parallel, 24 in 0.01 mm. Known from Crane Pond, North America, and from Demerara River South America. Common in Kizak Lake.

CYMBELLA MICROCEPHALA Grun. Plate 11, fig. 23.

Cymbella microcephala Grun. FR. HUSTEDT Bac. Mar. (1880) 351, fig. 637.

Valve linear with rostrato-capitate ends. Length, 0.017 mm; breadth, 0.0034. Striae very fine, 28 in 0.01 mm. Common in fresh water.

CYMBELLA ALPINA Grun. Plate 12, fig. 19.

Cymbella alpina Grun., A. SCHMIDT Atlas Diatom. (1911) p. 373, fig. 17.

Valve slightly asymmetrical, alveolate. Length, 0.049 mm, breadth, 0.01. Striae 3 in 0.01 mm. Common in alpine regions.

CYMBELLA REINHARDTII Grun. Plate 3, fig. 13.

Cymbella Reinhardtii Grun. FR. HUSTEDT, Bac. Mar. 1880, 354, fig. 644.

Valve slightly asymmetrical elliptic-lanceolate, with convex dorsal and ventral margins. Axial and central areas broad.

Length, 0.032 mm breadth 0.019 Striae 15 0.01 mm
Known from Europe

CYMBELLA A. EHRENBERGII Kütz. Plate I fig. 3

Cymbella Ehrenbergii Frit. FR. HUSTEDT Bacillar. 1930, 3: 66, fig. 656

* Valve elliptico-ancestral. Length 0.105 mm breadth 0.03
Striae 9 in 0.01 mm Common in fresh water

CYMBELLA A. NAVICULIFORMIS Auerwald. Plate I fig. 6.

Cymbella naviculiformis Auerwald. FR. HUSTEDT Bacillar. 1930, 3: 67, fig. 657

Valve navicular form lanceolate with capitate and constricted ends. Length 0.032 mm breadth 0.0085 Striae 12 in 0.01 mm Central area circular Common in Kizak Lake Known from a pine regions.

CYMBELLA C. ASPERATA Kütz. Plate II fig. 23.

Cymbella asperata Kütz. A. SCHMIDT Atlas Diatom. 1931, p. 374, figs. 13, 14.

Valve slightly asymmetric with rostrate-capitate ends. Length 0.034 to 0.071 mm breadth 0.012 to 0.02 Striae 8 to 0.01 mm Known from Nippon

CYMBELLA BETEROLEURA Ehrh. var. MINOR Cleve. Plate II fig. 4

gymnetia sp. A. Schmidt Atlas Diatom. (1875, p. 102, figs. 1, 2

Valve slightly asymmetric, lanceolate with rostrate ends. Length 0.071 mm breadth 0.022 Central area large Striae 8 to 0.01 mm Known from fresh waters of far northern regions

CYMBELLA BETEROLEURA Ehrh. to NIPPONICA G. Griseb. Plate I fig. 13.

Valve linear-ancestral, attenuate, and with truncate ends. Length 0.04 mm breadth 0.01 Striae 8 to 9 in 0.01 mm linear. Axial area linear central area ovalular. Differs from the type in its small valve

CYMBELLA PROSTRATA Berkeley. Cleve. Plate II fig. 25.

Cymbella prostrata Berkeley. Cleve. FR. HUSTEDT Bacillar. 1930, 3: 68, fig. 659

Valve asymmetric with elevated dorsal and irregular ventral margins. Median line arcuate with long terminal fissures. Axial area lanceolate Striae parallel 7 ventral 6 dorsal, 0.01 mm Common in fresh and brackish waters.

Cymbella TURGIDA (Greg.) Cleve. Plate 11, fig. 26.

Cymbella turgida (Greg.) Cleve, FR. HUSTEDT, Bacillar. (1930) 358, fig. 660.

Valve lunate, with arcuate dorsal margin, slightly gibbous ventral margin. Length, 0.054 mm; breadth, 0.014. Striae 6 in 0.01 mm. Known from Aokiko Lake. Common in tropical regions.

Cymbella VENTRICOSA Kütz. Plate 11, figs. 3, 14, and 15.

Cymbella ventricosa Kütz., FR. HUSTEDT, Bacillar. (1930) 359, fig. 661.

Valve lunate with straight or slightly gibbous ventral margin. Length, 0.025 to 0.032 mm; breadth, 0.006 to 0.007. Striae 10 to 12 in 0.01 mm. Very common in fresh water.

Cymbella GRACILIS Rabh. Plate 12, fig. 5.

Cymbella gracilis Rabh., VAN HEURECK, Synopsis (1880-1881) pl. 3, figs. 20-21.

Valve narrow with slightly arcuate dorsal, and straight ventral margins. Length, 0.062 mm, breadth, 0.008. Striae 12 in 0.01 mm. Found in fresh water, especially in alpine regions.

Cymbella GRACILIS (Rabh.) Cleve ex. MINOR ex. nov. Plate 12, fig. 22.

Like the type, but smaller. Length, 0.018 mm; breadth, 0.0045. Striae 12 in 0.01 mm. Median line approximate to the ventral margin. Uncommon.

Cymbella AEGUALIS W. Smith. Plate 2, fig. 5; Plate 11, fig. 2.

Cymbella obtusa Greg., A. SCHMIDT Atlas Diatom. (1875) pl. 9, figs. 41-45.

Valve naviculiform and subclavate. Length, 0.032 to 0.042 mm; breadth, 0.0065 to 0.009. Striae radiate, 12 to 15 in 0.01 mm. Common in alpine regions. Known from Aokiko Lake.

Cymbella SINUATA Greg. Plate 12, fig. 12.

Cymbella sinuata Greg., FR. HUSTEDT, Bacillar. (1930) 361, fig. 668a.

Valve linear, slightly asymmetrical, gibbous in the middle with obtuse ends. Length, 0.02 mm; breadth, 0.005. Striae 12 in 0.01 mm. Reported from Aokiko Lake.

Cymbella SINUATA Greg. var. *ANTIQUA* Grun. Plate 2, fig. 17.

Cymbella sinuata Greg. var. *antiqua* Grun. PANTOCSEK, Fossile Bacillar. Ungarns (1905) 141, pl. 29, fig. 31.

Valve linear with capitate ends. Length, 0.018 mm; breadth, 0.0068. Striae 5 to 6 in 0.01 mm. The typical variety *antiqua* is larger, being 0.032 to 0.033 mm in length. Known only as a fossil from Hungary.

CYMBELLA TURCIDULA Grun. Plate 11, fig. 24

Cymbella turcidula Grun. A. SCHMIDT, Atlas Diatom. (1875) pl. 9, figs. 23-26.

Valve asymmetrical with rostrate and obtuse ends. Length 0.029 mm, breadth 0.011. Striae 9 to 10 in 0.01 mm. On the ventral side of the central nodules are two puncta. Known from the Tropics.

CYMBELLA AFFINIS Kütz. Plate 11, figs. 9 and 10.

Cymbella affinis Kütz., Fr. HUSTERT Bacillar. (1930) 362, fig. 61.

Valve cymbiform with truncate ends. Length, 0.035 to 0.053 mm, breadth, 0.0085 to 0.012. Striae 8 to 10 in 0.01 mm. Known from Nippon.

CYMBELLA HYBRIDA Grun. Plate 5, fig. 23.

Cymbella hybrida Grun., CLEVE Synopsis Navicul. Diatoms (1894) 1 196, pl. 4, fig. 23.

Navicula rhynchocéphala Kütz. var. *hansensii* SKVORTZOV Diatoms from Sakhal Lake (1929) 49, pl. 4, fig. 22.

Valve navicular form. Near with parallel margins and truncate ends. Striae lineolate convergent in the middle, convergent at the ends, 9 in 0.01 mm. The median striae opposite the stigma, shortened. Axial areas narrow, linear widened in the middle. Length, 0.063 mm, breadth 0.0085. Known from fresh water and very slightly brackish water in Sweden, reported from Hanka Lake, Siberia. Common in Kizaki Lake.

CYMBELLA JAPONICA Reich. Plate 10, fig. 4. Plate 11, figs. 5 and 6.

Cymbella japonica Reichelt A. SCHMIDT, Atlas Diatom. (1931) pl. 11, figs. 29-31.

Cymbella signata Grun. var. *chinesis* SKVORTZOV Diatoms from South China (1929) 46, pl. 9, fig. 21.

Valve sublinear subelavate with a truncate rounded ends. Length, 0.042 to 0.08 mm, breadth 0.012 to 0.014. Striae roset slightly radiate, 6.5 to 8 in 0.01 mm, distinct lineolate. Median line arcuate, broad with reflexed terminal fissures. Near the central nodules one stigma. Known from Yokohama on rivers in Aokike Lake, and common in Kizaki Lake. Reported from a mountain stream near Foochow, southern China.

CYMBELLA CYMBIFORMIS (Agardh, Kütz.) Van Heurck. Plate 11, fig. 2.

Cymbella cymbiformis (Agardh, Kütz.) Van Heurck Fr. HUSTERT Bacillar. (1930) 362, fig. 67.

Valve boat-shaped, with slightly gibbous ventral margin and acute, truncate ends. Length 0.051 to 0.076 mm, breadth,

0.008 to 0.015. Striae 7 to 10 in 0.1 mm. At the ventral side of the central node a distinct isolated punctum. Common in fresh water. Known from Nippon.

CYMBELLA (CISTICA) Hemmrichi Grun. Plate 3 fig. 20.

Cymbella cistica (Hemmrich) Van Heurck Synopsis (1880-1881) p. 2, fig. 2.

Valve cymbiform. Length, 0.050 to 0.093 mm, breadth, 0.017 to 0.017. On ventral side one or two isolated puncta. Common in fresh water.

CYMBELLA ASPLEA Ehr. Cleve var. TRINCATA Rabh. Dipt. Plate 9 fig. 15.

Cymbella asplea var. *truncata* (Rabh.) Dipt. A. Mayer Die Bacill. d. Reinsüßwasser 1913: 262, p. 13 fig. 20.

Valve cymbiform with truncate ends. Length 0.13 mm, breadth 0.025. Striae 8 in 0.01 mm. Common.

CYMBELLA TUMIDA Bréb. Van Heurck Plate 1 fig. 17.

Cymbella tumida (Bréb.) Van Heurck FR. Hustedt Bac. La. 1930: 366, fig. 677.

Valve boat-shaped with rostrate-truncate ends. Length 0.057 mm, breadth, 0.017. Striae 9 in 0.01 mm. Reported from Nippon.

CYMBELLA TUMIDA Bréb. Van Heurck var. BOREALIS Grun. Plate 1 fig. 16.

Cymbella tumida (Bréb.) Van Heurck var. *borealis* Grun. SKVORTZOW Diatoms of Hanka Lake (1929) p. 7, fig. a.

Valve cymbiform and truncate. Length 0.085 mm, breadth, 0.017. Striae 8 in 0.01 mm. Common in fresh water.

CYMBELLA KAWAMURAE sp. nov. Plate 15, fig. 10.

Valve naviciform, lanceolate, with attenuate and capitate ends. Striae strong, radiate, not striate, in the middle of unequal length 12 in 0.01 mm. Axial area very narrow, central elliptical with two isolated puncta. Length 0.027 mm, breadth 0.009. A distinct species, named in honor of Prof. Dr. T. Kawamura of Kyoto Nippon.

COMPHONEMA VAST M. Hustedt Plate 3 fig. 3.

Comphonema vastum H. Hustedt Bac. La. 1930: 366, fig. 677.

Valve clavate with slightly capitate apex and narrow base. Length, 0.028 mm, breadth, 0.006. Striae short, marginal 12 in 0.01 mm. Axial area broad. Central area with one isolated punctum. Reported only from Aokiko Lake, Nippon.

GOMPHONEMA VASTUM Hustedt var CINEATA var nov. Plate 10. fig. 11

Valve with cuneate apex. Length, 0.039 mm, breadth, 0.005 mm. Striae 15 in 0.01 mm.

GOMPHONEMA VASTUM Hustedt var ELONGATA var nov. Plate 11. figs. 33 and 34.

Valve with elongate apex. Length, 0.028 to 0.034 mm, breadth, 0.005 to 0.006 mm. Striae 12 to 17 in 0.01 mm. Common in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. Plate 13. fig. 39.

Gomphonema acuminatum Ehr., FR. HUSTEDT Bac. Mar. (1930) 370 fig. 683.

Valve clavate and biconstricted. Striae 10 to 11 in 0.01 mm. Length, 0.034 mm, breadth 0.085. Common in fresh water.

GOMPHONEMA ACUMINATUM Ehr. var TURRIS Ehr. Cleve. Plate 12. fig. 4.

Gomphonema acuminatum Ehr. var *turris* (Ehr.) Cleve. A. SCHMIDT Atlas Diatom. (1902) pl. 239, figs. 34-36.

Valve slightly biconstricted. Striae 16 to 18 in 0.01 mm. Length, 0.047 mm, breadth, 0.085. Common in fresh water. Rare in Kizaki Lake.

GOMPHONEMA ACUMINATUM Ehr. var CORONATA Ehr. W. Smith. Plate 12. fig. 5.

Gomphonema acuminatum Ehr. var *coronata* Ehr. W. Smith FR. HUSTEDT Bac. Mar. (1930) 370 fig. 684.

Valve slightly biconstricted, elongate. Length, 0.069 mm, breadth, 0.01. Rare in Kizaki Lake.

GOMPHONEMA PARVUM Kütz. Grun. Plate 13. figs. 16 and 34.

Gomphonema parvum Kütz. Grun. A. SCHMIDT Atlas Diatom. (1902) pl. 234. fig. 14.

Valve elliptic-clavate with capitate ends. Length 0.02 mm, breadth, 0.0065. Striae 14 to 15 in 0.01 mm. Common in fresh water.

GOMPHONEMA PARVUM Kütz. Grun. var EXILISSIMA Grun. Plate 13. fig. 2.

Gomphonema parvum (Kütz.) Grun. var *exilissima* Grun., VAN HEURECK Synops. s (1880-1881) pl. 25. fig. 12.

Valve narrow, lanceolate. Length, 0.017 mm, breadth, 0.0042. Striae 15 in 0.01 mm. Uncommon.

GOMPHONEMA PARVUM Kütz. Grun. var MICROPS Kütz. Cleve. Plate 13. fig. 3.

Gomphonema parvum Kütz. Grun. var *microps* (Kütz.) Cleve. FR. HUSTEDT Bac. Mar. (1930) 373 fig. 7, 36.

Valve slightly clavate with obtuse apex. Length, 0.011 mm, breadth 0.005. Striae 15 in 0.01 mm.

GOMPHONEMA PARVUM Kütz. *Grün* var. *MICROPUS* Kütz. *Cleve* f. *NIPPONICA* f. *nov.* Plate 13, fig. 36.

Valve minute, subovate with obtuse apex. Length, 0.009 mm, breadth 0.0029. Striae 18 in 0.01 mm. Isolated puncta distinct. Differs from variety *micropus* in its closer striae and smaller size.

GOMPHONEMA LANCEOLATUM Ehr. var. *INSIGNIS* Greg. *Proc.* Plate 13, fig. 37.

Gomphonema lanceolatum Ehr. var. *insignis* Greg. *Cleve* f. *Hindustani* Bac. *Proc.* 1930, 372, fig. 191.

Valve lanceolate, clavate apex acuminate, slightly capitate. Length, 0.04 to 0.06 mm, breadth, 0.0085 to 0.015. Striae 8 to 9 in 0.01 mm. Common in fresh water.

GOMPHONEMA ANGUSTUM Ehr. Plate 13, fig. 38.

Gomphonema angustum Ehr. f. *Hindustani* Bac. *Proc.* 1930, 372, fig. 688.

Valve clavate with broad truncate-apiculate apex. Length, 0.021 mm, breadth, 0.02. Striae 10 in 0.01 mm. Uncommon in Krzaki Lake.

GOMPHONEMA ANGUSTUM Ehr. var. *GALTIERI* Van Heurck.

Gomphonema angustum Ehr. var. *Galtieri* Van Heurck f. *Hindustani* Bac. *Proc.* 1930, 372, fig. 689.

Like the type, but with longer valve. Length 0.051 mm, breadth 0.01. Common in Krzaki Lake.

GOMPHONEMA QUADRIPUNCTATUM (Oestr.) Wislouch var. *HASTATA* Wislouch. Plate 10, fig. 31.

Gomphonema quadripunctatus (Oestr.) Wislouch var. *hastata* Wislouch. *Neue Untersuchungen über die Diatomeen des Baku-Beckens* 1924, 166, 167, figs. a-e.

Valve clavate with atretic and broad apex. Length, 0.044 mm, breadth, 0.009. Striae radiate 11 to 13 in 0.01 mm. Central area a broad fascia with few isolated puncta. Median line straight, with long terminal fimbriae. Rare. Reported from northern Europe, Baku Lake, Manchuria and Mongolia.

GOMPHONEMA STIRILE Ehr. var. *SACCTA* Schumann. Plate 10, fig. 19.

Gomphonema stirile Ehr. var. *saccta* Schumann, A. *Schindler* Atlas Diatom. 1903, pl. 236, fig. 13.

Valve clavate with slightly capitate apex and narrow disc. Length, 0.028 mm, breadth 0.0034. Striae 11 in 0.01 mm. Area a narrow line. Known from Europe.

GOMPHONEMA LINGULATUM Husted. Plate 13, figs. 6 and 7.

Gomphonema lingulatum Husted. Bac. *Proc.* 1930, 372, fig. 192. Aoshima Japan 166-167, pl. 5, fig. 4.

Valve clavate with broad, truncate, apiculate apex and narrow base. Length, 0.023 to 0.03 mm; breadth, 0.0068 to 0.008 Striae marginal, 15 in 0.01 mm. No isolated punctum. Known only from Aokiko Lake, Nippon.

GOMPHONEMA OBLIVACIUM (Lyngb.) Kütz. Plate 13, fig. 72.

Gomphonema olivaceum (Lyngb.) Kütz., Fr. Hustvedt, Bacillar (1930) 379, fig. 719.

Valve subclavate with broad, obtuse apex. Length, 0.024 mm, breadth, 0.006. Striae 15 in 0.01 mm. Common in fresh water.

GOMPHONEMA OBLIVACIUM (Lyngb.) Kütz. var. *MINUTISSIMA* Hustvedt, Plate 13, fig. 72.

Gomphonema olivaceum (Lyngb.) Kütz. var. *minutissima* HUSTVEDT, Bacillar (1930) 379-379, fig. 720.

Like the type, but smaller. Length, 0.01 mm; breadth, 0.004. Striae 15 in 0.01 mm. Uncommon.

GOMPHONEMA GRACILE Ehr. var. *LANCEOLATA* (Cleve.) Cleve. Plate 14, fig. 8.

Gomphonema gracile Ehr. var. *lanceolata* (Kütz.) Cleve, A. SCHMIDT, Atlas Diatom. (1903) pl. 236, figs. 25-28.

Valve lanceolate-clavate, with apiculate apex. Length, 0.036 mm; breadth, 0.0065. Striae 15 in 0.01 mm. In fresh water, common in the Tropics.

GOMPHONEMA ABBREVIATUM Agardh? Kütz. Plate 13, fig. 73.

Gomphonema abbreviatum Agardh? Kütz. Fr. Hustvedt, Bacillar (1930) 379, fig. 722.

Valve clavate with broad ends. Length, 0.017 mm, breadth, 0.0034. Striae marginal, 15 in 0.01 mm. Axial and central areas uniting in a broad linear-lanceolate space. Reported from fresh and brackish waters.

GOMPHONEMA INTRICATUM Kütz. Plate 13, figs. 74 and 75.

Gomphonema intricatum Kütz., A. SCHMIDT, Atlas Diatom. (1903) pl. 236, figs. 16-17.

Valve sublinear, slightly gibbous in the middle with obtuse apex and base. Length, 0.035 to 0.044 mm; breadth, 0.0046 to 0.0085. Striae 12 in 0.01 mm. Common in fresh water.

GOMPHONEMA CONSTRICTUM Ehr. Plate 13, figs. 76 and 77.

Gomphonema constrictum Ehr., Fr. Hustvedt, Bacillar (1930) 377 fig. 714.

Valve clavate, biconstricted with rounded, truncate apex. Length, 0.039 to 0.044 mm; breadth, 0.01 to 0.014. Striae 9 to 10 in 0.01 mm. Common in fresh water.

GOMPHONEMA CONSTRICTUM Ehr. var. *CAPITATA* (Ehr.) Cleve. Plate 13, fig. 13

Gomphonema constrictum Ehr var *capitata* (Ehr.) Cleve, Fr. HUSTEDT, Bacillar. (1930) 377, fig. 715.

Valve clavate with broad, truncate ends. Length, 0.03 to 0.09 mm, breadth, 0.005 to 0.0085. Striae 12 in 0.01 mm. Common in Kizaki Lake.

GOMPHONEMA BERGGRENII Cleve. Plate 12, fig. 16.

Gomphonema Berggrenii Cleve, Synopsis Navicul. Diatoms (1894) 1, 185, pl. 5, figs. 6, 7; A. SCHMIDT, Atlas Diatom. (1903) pl. 240, figs. 26-30.

Valve clavate with broad subtruncate apex. Base elongate, narrow. Length, 0.044 mm, breadth, 0.0085. Axial area with an isolated punctum. The median stria opposite to the isolated punctum is shortened. Only known from fresh water in New Zealand.

GOMPHONEMA JAPONICA sp. nov. Plate 11, fig. 2; Plate 12, fig. 21.

Valve elongate, clavate with subtruncate and constricted apex. Ends long, attenuate, obtuse. Length, 0.056 to 0.06 mm; breadth, 0.0085 to 0.01. Striae robust, 9 in 0.01 mm. Axial area narrow, narrowed to the middle, unilateral. Central area unilaterial, opposite to the stigma a broad stauros. Not common in Kizaki Lake. *Gomphonema bohemicum* Reichelt and Fr.cko and *G. dubius* Menster are nearly related to this new species.

EPITHEMIA ENTOLA (Ehr.) var. *LUNARIS* Grun. Plate 1, fig. 11.

Epithemia entola (Ehr.) var. *lunaris* GRUNOW, Beiträge zur Kenntnis der fossilen Diatomeen Ostereich-Ungarns (1903) 137-138, pl. 20, figs. 1, 2.

Epithemia hydnocensis W. Smith var. *chusensis* SEVORTZOW, Alpine Diatoms from South China (1929) 46, pl. 2, figs. 22, 23, pl. 2, fig. 9.

Valve lunate, gibbous on the dorsal side. Ends long, obtuse. Length, 0.057 to 0.06 mm; breadth, 0.011 to 0.014. Costae 3, striae 15, in 0.01 mm. Reported from fresh water in Bengal, India, from Foochow, southern China, and as a fossil from Du-bravica, Hungary.

EPITHEMIA ZEBRA (Ehr.) Kütz.

Epithemia zebra (Ehr.) Kütz., Fr. HUSTEDT, Bacillar. (1930) 384-385, fig. 729.

Valve linear with straight ventral side. Length, 0.085 mm, breadth, 0.01. Costae 4, striae 15, in 0.01 mm. Known from Aokko Lake.

EPITHEMIA ZEBRA (Ehr.) Kütz. var. *SAXONICA* (Kütz.) Grun. Plate 12, fig. 21.

Epithemia zebra (Ehr.) Kütz. var. *saxonica* (Kütz.) Grun., Fr. HUSTEDT, Bacillar. (1930) 385, fig. 730.

Valve linear curved. The obtuse ends are lightly turned downwards. Length, 0.034 mm, breadth 0.01. Striae 11 to 14 in 0.01 mm. Not common in Kizak Lake.

EPITHEMIA SOREX Kütz. Plate 3, fig. 7.

Epithemia sores Kütz., FR. H. STEDT, Bac. Lat. (1930) 388, fig. 76.

Valve broad, gibbous on the dorsal side, slightly curved on the ventral side. Length, 0.025 mm, breadth 0.008. Common in fresh and brackish waters. Reported from Aokiko Lake, Nippon.

RHOPALODIA CIBBA Ehr. O. Moll. Plate 2, fig. 2.

Rhopalodia gibba (Ehr.) M. L. FR. H. STEDT, Bac. Lat. (1930) 390, fig. 740.

Valve linear, arcuate, straight on the cranial side, reflexed at the extremities. Costae 6 in 0.01 mm. Length, 0.111 mm, breadth 0.0085. Common in Kizak Lake.

RHOPALODIA GIBBULA (Ehr.) O. Moll. Plate 2, fig. 17.

Rhopalodia gibbula (Ehr.) O. Moll. FR. H. STEDT, Bac. Lat. (1930) 391, fig. 742.

Valve gibbous in the middle of the dorsal side and straight on ventral side. Length 0.045 mm, breadth, 0.022. A species of brackish waters. Not common in Kizak Lake.

RHOPALODIA PARALLELA (Grun.) O. Moll. Plate 2, fig. 1; Plate 3, fig. 11.

Rhopalodia parallela (Grun.) O. Moll. FR. H. STEDT, Bac. Lat. (1930) 389-390, fig. 743.

Valve linear with parallel margins. Length 0.062 to 0.2 mm, breadth, 0.018 to 0.03. Costae 5 to 6 in 0.01 mm. Striae 16 in 0.01 mm. An a priori species known from many parts of the world.

NITZSCHIA FORTICORNIA (Grun.) Plate 13, fig. 35.

Nitzschia forticornia (Grun.) FR. H. STEDT, Bac. Lat. (1930) 415, fig. 800.

Valve lanceolate with obtuse ends. Length 0.01 mm, breadth, 0.0034. Costae 12, striae 24, in 0.01 mm. Not common in Kizak Lake.

NITZSCHIA SIGMOIDEA (Ehr.) W. Smith. Plate 10, fig.

Nitzschia sigmoidea (Ehr.) W. Smith. FR. H. STEDT, Bac. Lat. (1930) 419, fig. 810.

Valve sigmoid with parallel margins. Length, 0.34 to 0.48 mm, breadth, 0.01. This is the largest *Nitzschia* species in Kizak Lake. Known from Aokiko Lake.

NITZSCHIA INTERRUPTA (Reichenow) Husted. Plate 12, fig. 1.

Nitzschia weissacensis var. *Heideni* MEISTER, in Beiträge zur Bacillar Japan (1914) 229, pl. 8, fig. 10.

Nitzschia (weissacensis) Heideni var. ? *Heideni* Meister A. SCHMIDT Atlas Diatom. (1924) pl. 351, figs. 2-13.

Nitzschia denticula GRUN., Diatom. Vega-Exped. (1883) 492 p. 3 fig. 68.

Denticula interrupta Reichenow, KUNZE, Revision 3, 392, fig.

Valve lanceolate with attenuate and slightly capitate ends. Costae long, irregularly disposed, 5 in 0.01 mm. Striae robust, elongate, 14 to 15 in 0.01 mm. Length, 0.03 to 0.035 mm, breadth, 0.0068 to 0.007. Common in Kizaki Lake. Reported from Aokiko Lake.

NITZSCHIA PALEA (Kütz.) W. Smith. Plate 12, figs. 15 and 26.

Nitzschia palea (Kütz.) W. Smith, FR. HUSTEDT, Bacillar. (1930) 416, fig. 801.

Valve linear-lanceolate with attenuate ends. Length 0.029 to 0.032 mm; breadth, 0.0025 to 0.0042. Costae 11 to 12 in 0.01 mm. Striae very fine, about 35 in 0.01 mm. Common in Kizaki Lake.

NITZSCHIA PALEA (Kütz.) W. Smith var. *LEUCOSTRIS* Grun. Plate 12, fig. 2.

Nitzschia palea (Kütz.) W. Smith var. *leucostris* GRUN., SEVOSTZOW Diatom. recoltées par le Pere E. Licent (1935) 43, pl. 9, fig. 40.

Valve linear-lanceolate, slightly constricted in the middle part. Ends slightly capitate. Length, 0.037 mm; breadth, 0.0042. Costae 10 to 11 in 0.01 mm. Striae 35 in 0.01 mm. Not common.

NITZSCHIA DISSEPTATA (Kütz.) Grun. Plate 12, figs. 17, 18, and 25.

Nitzschia disseptata (Kütz.) Grun., A. SCHMIDT, Atlas Diatom. (1924) pl. 332, fig. 23.

Valve linear-lanceolate with attenuate ends. Length, 0.02 to 0.037 mm; breadth, 0.0034 to 0.051. Costae 7 in 0.01 mm. Striae very fine, indistinct. Common in Kizaki Lake.

NITZSCHIA RECTA Husted. Plate 12, fig. 25.

Nitzschia recta Husted, FR. HUSTEDT, Bacillar. (1930) 411, fig. 785.

Valve linear with truncate, obtuse ends. Length, 0.093 to 0.098 mm; breadth, 0.005 to 0.006. Costae 5 to 6 in 0.01 mm. Striae indistinct. Common in fresh water.

NITZSCHIA COMMUNIS Rabenh. Plate 12, fig. 15.

Nitzschia communis Rabenh., FR. HUSTEDT, Bacillar. (1930) 417, fig. 798.

Valve broad-lanceolate with obtuse ends. Length, 0.014 mm; breadth, 0.0034. Costae 12 in 0.01 mm. Striae very indistinct. Common in fresh water.

NITZSCHIA CAMPITELLATA Hustedt var. *NIIPPONEA* var. nov. Plate 13, fig. 20.

Valve linear-lanceolate, constricted and rostrate-capitate. Length, 0.072 mm; breadth, 0.005. Costae 7, striae 30, in 0.01 mm. Differs from the type in its constricted valve and the different number of costae.

NITZSCHIA VITREA Norman? Plate 13, fig. 23.

Nitzschia vitrea Norman, A. SCHNODT, Atlas Diatom. (1921) p. 334 figs. 16, 17.

Valve lanceolate, attenuate, and subrostrate. Length, 0.045 mm; breadth, 0.006. Costae long, 8 in 0.01 mm. Striae 18 in 0.01 mm. The Nippon form differs from the type in its short valve. A fresh-water species.

NITZSCHIA ACICULARIS W. Smith var. *NIIPPONICA* var. nov. Plate 13, fig. 22.

Valve lanceolate with long horns or beaks. Length, 0.054 to 0.068 mm; breadth, 0.002 to 0.0025. Valve hyaline without striae. Common in Kizaki Lake.

HANTZSCHIA AMPHIOPSYS (Ehr.) Grun. Plate 13, fig. 13.

Hantzschia amphipsys (Ehr.) Grun., FR. HUSTEDT, Bacillar. (1930) 394, fig. 747.

Valve lanceolate, constricted at one side, convex from the other. Ends truncate, slightly curved. Length, 0.032 mm; breadth, 0.006. Costae 8 to 9, striae 18, in 0.01 mm. Common in Kizaki Lake.

HANTZSCHIA ELONGATA (Hantz.) Grun. Plate 5, fig. 3.

Hantzschia elongata (Hantz.) Grun., FR. HUSTEDT, Bacillar. (1930) 395, fig. 751.

Valve linear-lanceolate, attenuate towards the ends. Length, 0.195 mm; breadth, 0.01. Costae 5, striae 15, in 0.01 mm. Not common in Kizaki Lake.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. *GRACILIS* Grun. Plate 15, fig. 4.

Cymatopleura solea (Breb.) W. Smith var. *gracilis* Grun., FR. HUSTEDT, Bacillar. (1930) 423.

Valve linear, constricted in the middle, panduriform, cuneate at both ends. Length, 0.127 to 0.13 mm; breadth, 0.018 to 0.019. Reported from Aokiko Lake, Nippon.

CYMATOPLEURA SOLEA (Breb.) W. Smith var. REGULA (Ehr.) Grun. Plate 15, fig. 7

Cymatopleura solea (Breb.) W. Smith var. *regula* (Ehr.) Grun., FR. HUSTEDT, Bacillar. (1930) 426, fig. 823b.

Valve linear, not constricted. Length, 0.062 mm; breadth 0.001. Rare.

CYMATOPLEURA ELLIPTICA (Breb.) W. Smith. Plate 14, fig. 1.

Cymatopleura elliptica (Breb.) W. Smith, FR. HUSTEDT, Bacillar (1930) 426, fig. 825.

Valve broad-elliptic, cuneate. Length, 0.111 to 0.15 mm, breadth, 0.05 to 0.052. Common in Kizaki Lake.

SARRELLA BISERIATA Breb. Plate 14, fig. 12.

Sarrella biseriata Breb., FR. HUSTEDT, Bacillar (1930) 432 fig. 831

Valve lanceolate with acute ends. Costae reaching the median line 2 in 0.01 mm. Long diameter, 0.142 mm; short diameter 0.024. Common. Known from Aokiko Lake.

SARRELLA BISERIATA Breb. fo. PUNCTATA Meister.

Sarrella biseriata Breb. fo. *punctata* Meister, FR. HUSTEDT, Bacillar (1930) 433.

A form covered with puncta. Long diameter, 0.17 mm; short diameter, 0.032. Costae 2 in 0.01 mm. Not common. Reported from Europe.

SARRELLA BISERIATA Breb. var. NIPPONICA var. nov. Plate 14, fig. 13

Valve elongate-lanceolate with acute ends. Costae 2 to 3 in 0.01 mm. Long diameter, 0.2 to 0.23 mm, short diameter, 0.028 to 0.03. Differs from the type in its longer valve. *Sarrella Eugleri* O. Mull. var. *hankensis* Skvortzow² seems to be related to the above species. Common in Kizaki Lake.

SARRELLA BISERIATA Breb. var. NIPPONICA fo. PUNCTATA fo. nov. Plate 14, fig. 13

Valve punctate. Long diameter, 0.25 mm, short diameter, 0.027. Costae 2 in 0.01 mm. Not common.

SARRELLA BISERIATA Breb. var. CONSTRICTA Grun. fo. PUNCTATA fo. nov. Plate 14, fig. 14.

Valve constricted, acute and punctate. Median line linear. Long diameter, 0.12 mm; short diameter, 0.022. Known from Europe.

² Diatoms of Hanka Lake (1929) 37, pl. 8, fig. 3.

SURIRELLA BISEPTATA Ehrh. var. *BIFRONS* (Ehr.) Husted. f. *BIFIDA* f. nov. Plate 14, fig. 1.

Valve short-elliptic with acute ends, irregularly covered with spines. Long diameter, 0.102 mm; short diameter, 0.047. The variety *bifrons* was reported from Aokiko Lake.

SURIRELLA ROBUSTA Ehr. f. *LATA* Husted. Plate 16, fig. 10.

Surirella robusta Ehr. f. *late* HUSTED, Bacillar. aus dem Aokikossee in Japan 170, fig. 1.

Valve ovate with one end much broader than the other. Costae short, 1.5 to 2 in 0.01 mm, not reaching the pseudoraphe. Marginal keel forming wings in the middle part of the costae. Pseudoraphe lanceolate. Polar areas large. Long diameter, 0.072 mm; short diameter, 0.03. Reported only from Nippon. Common in Kizaki Lake.

SURIRELLA ROBUSTA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck. Plate 14, fig. 3.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck, Fa. HUSTED, Bacillar. (1930) 437, figs. 551-552.

Valve narrow ovate, rounded at one end and acute at the other. Costae not reaching the median area. Long diameter, 0.093 to 0.136 mm; short diameter, 0.025 to 0.047. Common. Reported from Aokiko Lake.

SURIRELLA ROBUSTA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck f. *HUSTEDIANA* (Mayer) Husted.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck f. *Hustediana* (Mayer) HUSTED, Bacillar. (1930) 438.

Valve elliptic-lanceolate with acute ends. Costae not reaching the median area, parallel in the middle, radiate at the ends. Long diameter, 0.115 mm, short diameter, 0.037. Costae 2 in 0.01 mm. Known from Europe.

SURIRELLA ROBUSTA Ehr. var. *SPLENDIDA* (Ehr.) Van Heurck f. *PUNCTATA* Husted. Plate 16, fig. 2.

Surirella robusta Ehr. var. *splendida* (Ehr.) Van Heurck f. *punctata* HUSTED, Bacillar. (1930) 437.

Valve with attenuate, rounded ends. Punctate between the costae. Long diameter, 0.111 mm, short diameter, 0.037. Costae 1 to 1.5 in 0.01 mm. Known from Europe.

SURELLA ROBUSTA Ehr. var. *SPLENDIDA* (Ehr.) Van Hessek fo. *CONSTRUCTA* Hust.
 dett. Plate 16, fig. 1.

Surella robusta Ehr. var. *splendida* (Ehr.) Van Hessek fo. *constructa*
 Hustet, Bacillar. (1930) 437.

Valve constricted. Long diameter, 0.153 mm; short diameter,
 0.037. Rare.

SURELLA LINEARIS W. Smith. Plate 15, fig. 11.

Surella linearis W. Smith, FR. HUSTET, Bacillar. (1930) 434, f.
 837

Valve linear with concave ends. Ala and costae distinct
 Median line linear. Long diameter, 0.042 mm; short diameter
 0.01. Costae 2.5 in 0.01 mm. Reported from Aokiko Lake

SURELLA LINEARIS W. Smith var. *CONSTRUCTA* (Ehr.) Grun. Plate 14, fig. 7

Surella linearis W. Smith var. *constructa* (Ehr.) Grun., FR. HUSTET
 Bacillar. (1930) 434, fig. 839.

Valve constricted. Long diameter, 0.072 mm; short diameter
 0.013. Costae 2 in 0.01 mm. Found in Aokiko Lake, Nippon

SURELLA LINEARIS W. Smith var. *HELVETICA* (Brun) Meister. Plate 16, fig. 5

Surella linearis W. Smith var. *helvetica* (Brun) Meister, FR. HUS-
 TET, Bacillar. (1930) 434, fig. 840.

Valve linear with parallel margins, cuneate and punctate
 Long diameter, 0.119 mm; short diameter, 0.034. Costae 1.5 in
 0.01 mm. Also reported from Aokiko Lake, Nippon.

SURELLA LINEARIS W. Smith var. *NIPPONICA* var. nov. Plate 15, fig. 9.

Valve linear with subcuneate ends, punctate. Outer rim
 robust. Marginal keel or ala distinct. Costae parallel. 2.5 to 3
 in 0.01 mm. Median line linear. Long diameter, 0.052 mm,
 short diameter, 0.014. Variety *nipponica* is closely connected
 with variety *helvetica*.

SURELLA LINEARIS W. Smith var. *NIPPONICA* fo. *CONSTRUCTA* fo. nov. Plate 16,
 fig. 3.

Valve constricted with attenuate and cuneate ends, punctate
 Median line linear. Long diameter, 0.064 mm; short diameter
 0.01 to 0.012. Costae 3 in 0.01 mm. Not common.

SURELLA LINEARIS W. Smith var. *APICULATA* var. nov. Plate 16, fig. 2.

Valve linear, slightly constricted with subrostrate ends.
 Costae parallel, 3 in 0.01 mm, reaching the median line. Long
 diameter, 0.076 mm; short diameter, 0.014.

STIRIELLA CAPRONII Breh. var. *ORTUSA* Hustedt. Plate 14, fig. 5.

Stirirella Capronii Breh. var. *obtus* HUSTEDT, Bacillar. a. d. Aokikozee in Japan 170, fig. 2.

Valve elongate-ovate with one end much broader than the other. Ends obtuse. Outer rim robust. Area distinct and robust. Costa not reaching the median area. On both ends of the median area two opposite horns. Polar area distinct. Long diameter, 0.136 mm; short diameter, 0.047. Known only from Aokiko and Kizaki Lakes.

STIRIELLA CAPRONII Breh. var. *ORTUSA* Hustedt. f. *CAPITATA* f. nov. Plate 14, fig. 4.

Valve slightly constricted, one end very broad. Alae and costae robust, 1 in 0.01 mm. Long diameter, 0.156 mm, short diameter, 0.051.

STIRIELLA ELEGANS Hust. f. *ELONGATA* f. nov. Plate 15, fig. 1.

Valve linear with one end much broader than the other. Costae parallel, radiate at the ends, not reaching the median line. Long diameter, 0.215 mm; short diameter, 0.044. Costae 2 in 0.01 mm. Differs from the type in its more elongate valves.

STIRIELLA TENERA Gregory. Plate 14, fig. 10.

Stirirella tenera Gregory, Fa. Hustert Bacillar. (1930) 438, fig. 853.

Valve elongate-ovate, rounded at one end and acute at the other. Outer rim narrow, smooth. Marginal alae distinct. Costae reaching the pseudoraphe, parallel in the middle, radiate at the ends. Long diameter, 0.138 to 0.11 mm; short diameter, 0.035. Common in fresh water. Not common in Kizaki Lake.

STIRIELLA TENERA Gregory var. *PUNCTATA* var. nov. Plate 14, fig. 11.

Punctate between the costae. Long diameter, 0.136 mm; short diameter, 0.04. Uncommon.

STIRIELLA TENERA Gregory var. *NERYOSA* A. Schmidt. Plate 14, fig. 12.

Stirirella tenera Gregory var. *neriosa* A. Schmidt, Fa. Hustert, Bacillar. (1930) 439, figs. 854-855.

Differs from the type in the median line being ornamented with a horn. Long diameter, 0.114 mm; short diameter, 0.034. Costae 2 in 0.01 mm. Uncommon.

STIRIELLA TERRANA Ward. Plate 16, fig. 11.

Stirirella Terrana Ward, A. Schmidt, Atlas Diatom. (1912) pl. 280, figs. 7-8.

Valve linear with obtuse ends, margins parallel or slightly constricted in the middle. Outer rim narrow, finely crossbarred.

Costæ or ribs reaching the pseudoraphe, 3 in 0.01 mm, parallel in the middle, slightly radiate at the ends. Between the costæ are fine, closely set, parallel lines. Common in Kizaki and Aokubo Lakes. Known from North and South America only. *Surirella Chochinax* Skvortzow² is closely connected with *Surirella Terryana*.

SURIURELLA TERRYANA Ward ex. *MINUTA* ex. nov. Plate 12, fig. 24. Plate 13, fig. 13.

Valve linear with parallel margins or slightly constricted, with rounded or cuneate ends. Costæ not reaching the pseudoraphe, 3 in 0.01 mm. Central area linear, extending the length of the valve. Long diameter, 0.037 to 0.04 mm; short diameter, 0.008 to 0.009. Striæ indistinct. Common.

SURIURELLA TERRYANA Ward var. *NIIPPONICA* var. nov. Plate 13, fig. 1.

Valve linear, constricted, with cuneate long ends. Outer rim narrow, finely crossbarred. Costæ or ribs 2 in 0.01 mm, slightly curved, reaching the pseudoraphe. Striæ distinct. Long diameter, 0.124 to 0.13 mm; short diameter, in the middle part 0.014, at the ends 0.019. Uncommon.

SURIURELLA OVALIS Griseb. var. *NIIPPONICA* var. nov. Plate 13, fig. 4.

Valve ovate with outer rim robust, crossbarred. Costæ short, 2 in 0.01 mm, not reaching the median area. Between the costæ are fine, closely set, parallel lines. Median area is bounded by a closely set row of transverse lines, 18 in 0.01 mm. Long diameter, 0.098 mm; short diameter, 0.042. Variety *niipponica* differs from the type in its set row of transverse lines around the median area. *Surirella ovalis* is known as a brackish-water diatom.

SURIURELLA ANGUSTATA Griseb. Plate 3, fig. 15.

Surirella angustata Griseb., PR. HUSTEDT, Bacillat. (1930), 435, figs. 844-846.

A minute species common in fresh water. Valve linear with cuneate ends. Costæ reaching the pseudoraphe, about 6 in 0.01 mm, parallel in the middle, radiate at the ends. Long diameter, 0.034 mm; short diameter, 0.011.

SURIURELLA PANTOCSEKII Meister. Plate 6, fig. 6.

Surirella Pantocsekii MEISTER, Beiträge zur Bacillat. Japans (1914) 230, pl. 8, figs. 14, 15.

Valve long-linear with panduriform rounded ends. Outer rim narrow, finely crossbarred. Costæ thin, short, parallel in the

² Diatoms from Hanka Lake (1929) 40, pl. 8, fig. 20

muscle, radiate at the ends with intercostal striae. Central area narrow. Long diameter, 0.102 to 0.108 mm; short diameter, in the middle part 0.01, at the ends 0.013. Five fine costae in 0.01 mm. Reported as occurring near Yokohama, Nippon. Known from Amur and Sungari Rivers, Manchuria. *Surirella tiensinensis* Skvortzow, from Tientsin, northern China, and from Hanka Lake, Siberia, differs from *S. Pantocsekii* only in its obtuse ends and smaller size.

SURIELLA NIPPONICA sp. nov. Plate 8, fig. 17.

Valve lanceolate with attenuate ends. Costae short, radiate, about 2 in 0.01 mm. Striae distinct. Median area broad. Differs from *Surirella delicatissima* Lewis⁴ in its broader valve and wider costae.

STENOPTEROBIA INTERMEDIA (Lewis) in *STYACUTA* Frick. Plate 10, fig. 14.

Stenopterobia intermedia (Lewis) in *subacuta* Frick, A. SCHMIDT, Atlas Diatom. (1912) pl. 284, fig. 6.

Valve sigmoid with inconspicuous ale. Length, 0.119 mm; breadth, 0.004. Striae 30 in 0.01 mm. Very rare. Known from Aokiko Lake (variety *capitata* Fontell.)

⁴A. Schmidt, Atlas Diatom. (1906) pl. 266, fig. 6.

ILLUSTRATIONS

PLATE I.

- FIG 1 *Metosira americana* Kütz
 2 *Metosira punctata* Ehr Kütz var *Normanni* Arnott
 FIGS 3 and 4 *Metosira Benderana* Kütz
 F 5 *Metosira sulca* (Ehr) Kütz subsp. *subarctica* O Mu
 6 *Metosira italica* Ehr Kütz var *formosana* (Grun) O Mu
 7 *Metosira sulca* (Ehr) Kütz var *arctica* Grun
 8 *Leptocampa granulata* (Ehr) Rafs.
 9 *Fragilaria pinnata* Ehr
 10 *Metosira distans* Ehr Kütz
 11 *Cyclotella alutacea* Cleve and Grun
 12 *Cyclotella glomerata* Bachmann f. *japonica* f. nov
 13 *Leptocampa hiemale* (Lyngb.) Heideberg var *mesodon* (Ehr) Grun.
 14 *Synedra Vaucheria* Kütz
 15 *Synedra Vaucheria* Kütz var *capitata* Grun
 16 *Tubularia flocculosa* (Roth) Kütz
 17 *Fragilaria constans* (Ehr) Grun var *binodis* Ehr Grun
 18 *Fragilaria binodis* Grun var *inflata* Hust f. nov
 19 *Leptocampa circumata* Agardh.
 20 *Synedra nipponica* Kütz var *nipponica* f. nov
 21 *Fragilaria capitata* Grun
 22 *Synedra nipponica* Kütz
 23 *Fragilaria gracilis* Mayer
 24 *Leptocampa hiemale* (Lyngb.) Heideberg.
 25 *Eunotia pinnata* Grun.
 26 *Fragilaria constans* Kütz
 27 *Synedra nipponica* Meister
 FIGS 28 and 29 *Fragilaria constans* Ehr Grun
 F 30 *Eunotia pinnata* Kütz Rabh var *nipponica* f. nov
 31 *Eunotia pinnata* Kütz O Mu var *nipponica* f. nov
 32 *Eunotia pinnata* Kütz Rabh var *nipponica* f. nov
 FIGS 33 and 34 *Asterionema gracilina* (Hantzsch) Lyngb.
 F 35 *Fragilaria pinnata* (Lyngb.) Kütz
 36 *Synedra lineata* (Nitzsch) Ehr
 37 *Synedra lineata* Nitzsch Ehr var *kaipes* Herib. and Perag.
 38 *Eunotia pinnata* Kütz var *staltiana* Meister
 39 *Synedra lineata* Nitzsch Ehr var *biocaps* (Kütz)
 40 *Eunotia pinnata* (Ehr) Rabh.
 41 *Eunotia pinnata* Hust
 42 *Synedra Vaucheria* Kütz var *sigmoidea* f. nov
 43 *Synedra nipponica* sp. nov
 44 *Eunotia pinnata* (Ehr) Grun

PLATE 2

- FIG. 1. *Diploneis Smithii* (Breb.) Cleve var. *nipponica* var. nov.
 2. *Diploneis pectus* (Schum.) Cleve
 3. *Diploneis elliptica* (Kütz.) Cleve var. *ludoyensis* Cleve
 4. *Diploneis oculata* (Breb.) Cleve.
 5. *Cocconeis placentalis* (Ehr.) var. *lineata* (Ehr.) Cleve
 6. *Diploneis elliptica* (Kütz.) Cleve var. *ludoyensis* Cleve
 7. *Navicula confervacea* Kütz. fo. *nipponica* fo. nov.
 8. *Cocconeis placentalis* (Ehr.) var. *linearis* Grütler fo. *nipponica* fo. nov.
 9. *Diploneis Smithii* (Breb.) Cleve var. *nipponica* var. nov.
 10. *Achnanthes Peragalli* Brun and Herib. var. *nipponica* var. nov.
 FIGS. 11 and 12. *Achnanthes lanceolata* Breb.
 FIG. 13. *Navicula atomaria* sp. nov.
 14. *Achnanthes Peragalli* Brun and Herib. var. *nipponica* var. nov.
 15. *Achnanthes minutissima* Kütz.
 FIGS. 16 to 18. *Cocconeis dimidiata* Pant?
 FIG. 19. *Achnanthes pinnata* Hust var. *nipponica* var. nov.
 20. *Achnanthes lanceolata* Breb. var. *restrata* Hust.
 21. *Achnanthes minutissima* Kütz. var. *cryptoccephala* Grun.
 22. *Achnanthes microcephala* Kütz.
 23. *Achnanthes minutissima* Kütz.
 24. *Achnanthes Clevei* Grun. var. *nipponica* var. nov.
 25. *Achnanthes kauli* sp. nov.
 26. *Diploneis oralis* (Hilse) Cleve var. *oblongella* (Naugeti) Cleve
 27. *Opheura Martyi* Herib.
 28. *Synedra Vaucheria* Kütz. var. *capitata* Grun.
 29. *Achnanthes lanceolata* Breb. var. *elliptica* Cleve.
 30. *Achnanthes Peragalli* Brun and Herib.
 FIGS. 31 and 32. *Achnanthes Oestrupii* (A. Cleve) Hust.
 FIG. 33. *Melosira varians* C. A. Ag.
 34. *Diatoma hiemale* (Lyngb.) Heiberg.
 35. *Navicula Pinnii* Cleve var. *arcuata* (Pantocsek) Skvortzow
 36. *Cocconeis arcus* Kütz. var. *amphioxys* (Rabh.)
 37. *Diploneis oralis* (Hilse) Cleve
 38. *Achnanthes exigua* Grun. var. *indica* Skv.
 39. *Eucocconeis flexilla* (Kütz.)

PLATE 3

- FIG. 1. *Navicula bisulcata* (Lagerst.) Cleve var. *nipponica* var. nov.
 2. *Navicula Brebii* Husted fo. *elongata* fo. nov.
 3. *Amphipleura pellucida* Kütz.
 4. *Navicula dicophala* (Ehr.) W. Smith.
 5. *Cymbella equalis* W. Smith.
 6. *Amphipleura pellucida* Kütz. var. *recta* Kitton.
 7. *Gyrosigma Külingii* (Grun.) Cleve.
 8. *Synedra Ulva* (Nitzsch) Ehr.
 9. *Caloneis nitida* Ehr. var. *bisulcata* Skv. and Meyer.
 10. *Navicula globulifera* Hust. var. *nipponica* var. nov.
 11. *Stauroneis Smithii* Grun.

- FIG. 12. *Amphora delphinus* (Bailey) A. S. var. minor Cleve.
 13. *Amphora parvifolia* Grun.
 14. *Amphora ovalis* Kütz. var. *pedunculata* Kütz.
 15. *Stauroneis angustata* Kütz.
 16. *Amphora ovalis* Kütz. fo. *gracilis* Ehr. Cleve.
 17. *Amphora ovalis* Kütz. var. *abyssa* (Ehr.) Cleve.
 18. *Amphora Normanii* Rabb.
 19. *Pinnularia mesolepta* (Ehr.) W. Smith.
 20. *Cymatella costata* (Hemp.) Grun.
 21. *Stauroneis phoenicenteron* Ehr. fo. *nipponica* fo. nov.
 22. *Synedra rumpens* Kütz. var. *Meneghiniana* Grun.
 23. *Navicula americana* Ehr.

PLATE 4

- FIG. 1. *Noidium italicum* Ehr.
 2. *Noidium prostratum* (W. Smith) Cleve fo. *sinuata* Hust.
 FIGS. 3 and 4. *Achnanthes gracillima* Hust. var. *nipponica* var. nov.
 FIG. 5. *Noidium oblique-striatum* A. S. var. *nipponica* var. nov.
 6. *Noidium affine* (Ehr.) Cleve fo. *herveyana* (A. Mayer) Hust.
 7. *Noidium lamella* Cleve var. *denigrata* var. nov.
 8. *Noidium basileatum* (Lagers.) Cleve var. *sinuata* var. nov.
 9. *Navicula ex qua* (Grev.) O. Muir.
 10. *Navicula pupula* Kütz. var. *capitata* Hust.
 11. *Frustulia vancouveris* Thwaites.
 12. *Frustulia rhomboides* (Ehr.) de Toni, var. *saxonica* Rabb. var. nov.
 13. *Navicula ulophylla* (Grun.) Cleve fo. *minor* Kütz.
 14. *Navicula muricata* Grun.
 15. *Navicula pseudoscutiformis* Hust.
 16. *Noidium oblique-striatum* A. S. var. *rosacea* var. nov.
 17. *Coroneis striatula* Ehr. Cleve var. *truncatula* Grun.
 18. *Frustulia rhomboides* (Ehr.) de Toni var. *amphioxys* Grun.
 19. *Frustulia rhomboides* (Ehr.) de Toni.
 FIGS. 20 and 21. *Navicula Fusca* Cleve.
 FIG. 22. *Noidium oblique-striatum* A. S. var. *nipponica* var. nov.
 23. *Navicula canaliculata* Kütz. fo. *nipponica* fo. nov.
 24. *Noidium oblique-striatum* A. S. var. *apiculata* var. nov.
 25. *Navicula Rostrata* (Rabb.) Grun.
 26. *Achnanthes punctata* Hust. var. *japonica* Hust.
 27. *Stauroneis Smithii* Grun. var. *sinuata* Pant.

PLATE 5

- FIG. 1. *Navicula laeta* Pant.
 2. *Navicula rhynchoccephala* Kütz.
 3. *Navicula costellata* Kütz.
 4. *Navicula lanceolata* (Agardh) Kütz.
 5. *Navicula placenticula* (Ehr.) Grun. fo. *rostrata* Mayer.
 6. *Navicula laetula* Grev.
 7. *Navicula globulifera* Hust.
 8. *Navicula rotunda* Kütz.
 9. *Navicula laeta* Pant. var. *lanicola* Grun.

- FIG. 10. *Navicula aqueducta* Krasske fo. *remota* Krasske.
 11. *Navicula crucicula* (W. Smith) Donk. var. *capitata* var. nov.
 12. *Navicula lapidosa* Krasske var. *nipponica* var. nov.
 13. *Navicula similis* Krasske.
 14. *Stauroneis anceps* Ehr. var. *linearis* (Ehr.) Cleve
 15. *Stauroneis anceps* Ehr.
 16. *Navicula meniscus* Schumann.
 17. *Navicula lanceolata* (Agardh) Kütz. var. *zygnata* (Donk) Cleve.
 18. *Navicula anglica* Balss.
 19. *Stauroneis phaeocentron* Ehr.
 20. *Stauroneis anceps* Ehr. fo. *proclia* (Ehr.) Cleve.
 21. *Navicula rehnianum* Grun. var. *nipponica* var. nov.
 22. *Navicula reticulata* Kütz. var. *nipponica* var. nov.
 23. *Cymbella hybrida* Grun.
 24. *Navicula peregrina* (Ehr.) Kütz. var. *curcata* var. nov.

PLATE 6

- FIG. 1. *Pinnularia platycephala* (Ehr.) Cleve.
 2. *Pinnularia platycephala* Cleve var. *Hattoriiana* Melator.
 3. *Pinnularia karstia* Cleve var. *japonica* Hust. fo. *obtus* fo. nov.
 4. *Pinnularia karstia* Cleve var. *japonica* Hust.
 5. *Pinnularia Hattoriiana* Greville.
 6. *Savillea Pantowskii* Melator.
 7. *Pinnularia microstauron* (Ehr.) Cleve var. *linearis* var. nov.
 8. *Pinnularia microstauron* (Ehr.) Cleve var. *nipponica* var. nov.
 9. *Achnanthes gracillima* Hust. var. *nipponica* var. nov.
 10. *Pinnularia major* (Kütz.) Cleve.
 11. *Pinnularia viridis* (Nitzsch) Ehr. var. *septogangula* (Ehr. Grun.) Cleve.
 12. *Pinnularia karstia* Cleve var. *linearis* var. nov.
 13. *Pinnularia melaria* Grun.
 14. *Pinnularia viridis* (Nitzsch) Ehr. var. *nipponica* var. nov.
 15. *Navicula falsimennus* Grun. var. *nipponica* var. nov.
 16. *Navicula cuspidata* Kütz.

PLATE 7

- FIG. 1. *Pinnularia Uva* sp. nov.
 FIGS. 2 and 3. *Pinnularia gibba* Ehr.
 FIG. 4. *Pinnularia legumens* Ehr. var. *nipponica* var. nov.
 5. *Pinnularia dactylus* Ehr. var. *Darwinia* A. S. fo. *nipponica* fo. nov.
 6. *Pinnularia microstauron* (Ehr.) Cleve.
 FIGS. 7 and 8. *Achnanthes exigua* Grun. var. *nipponica* var. nov.
 FIG. 9. *Pinnularia viridis* (Nitzsch) Ehr. var. *intermedia* Cleve.
 10. *Pinnularia gibba* Ehr. var. *nipponica* var. nov.
 11. *Pinnularia major* (Kütz.) Cleve var. *linearis* Cleve.
 12. *Pinnularia nipponica* sp. nov.
 13. *Pinnularia Okamura* sp. nov.
 14. *Navicula cryptoccephala* Kütz. var. *veneta* (Kütz.) Grun.

- FIG. 15 *Pinnularia gibba* Ehr. fo. *subundulata* Mayer
 16, *Achnanthes exigua* Grun.
 17 *Pinnularia borealis* Ehr.
 18 *Pinnularia microstauron* (Ehr.) Grun. nr *exigua* Meister fo. *diminuta* Grun.

PLATE 8

- FIG. 1 *Nendium nipponica* sp. nov.
 2 *Pinnularia viridis* (Nitzsch) Ehr. var. *nipponica* var. nov.
 3 *Hantzschia elongata* (Hantz.) Grun.
 4 *Navicula palia* sp. nov.
 5 *Pinnularia Hustedii* Meister.
 6 *Pinnularia legumosa* Ehr.
 7 *Rhopalodia parvula* (Grun.) O. Mull.
 8 *Achnanthes lanceolata* Grun. var. *rostrata* Hust.
 9 *Navicula lacustris* Grun.
 10 *Eunotia tropica* Hust.
 11 *Actinella brasiliensis* Grun.
 12 *Rhopalodia gibberula* (Ehr.) O. Mull.
 13 *Cyclotella comita* (Ehr.) Kütz. fo. *parva* fo. nov.
 14 *Cyclotella Meneghiniana* Kütz. var. *nipponica* var. nov.
 15 *Pinnularia leptosoma* Grun. var. *nipponica* var. nov.
 16 *Eunotia tronica* Hust.
 17 *Sulirella nipponica* sp. nov.

PLATE 9

- FIG. 1, *Diploneis Smithii* (Grun.) Cleve var. *oblongella* var. nov.
 2 *Rhopalodia gibba* (Ehr.) O. Mull.
 3 *Caloneis afflicta* (Ehr.) Cleve var. *tumida* Hust. fo. *nipponica* fo. nov.
 4 *Stauroneis phoenicenteron* Ehr. fo. *nipponica* fo. nov.
 5 *Pinnularia tabellaria* Ehr.
 6 *Navicula peruviana* Grun.
 7 *Pinnularia viridis* (Nitzsch) Ehr. var. *fallax* Cleve.
 8 *Navicula leptosoma* Grun.
 9 *Pinnularia montana* Hust. fo. *minor* fo. nov.
 10 *Pinnularia microstauron* (Ehr.) Cleve var. *nipponica* var. nov.
 11 *Rhopalodia parvula* (Grun.) O. Mull.
 12 *Epithemia cistula* (Ehr.) var. *lunaria* Grun.
 13 *Ceratoneis arcus* Kütz. var. *amphioxys* (Rabh.)
 14 *Gyrodinium acuminatum* (Kütz.) Rabh.
 15 *Fragilaria virescens* Rabh.
 16 *Ceratoneis arcus* Kütz. var. *amphioxys* (Rabh.)
 17 *Cymbella stylata* Grun. var. *antiqua* Grun.
 18 *Diatoma lineale* (Lyngb.) Heberg var. *mesodon* (Ehr.) Grun.
 19 *Cymbella aperta* (Ehr.) Cleve var. *tomenta* (Rabh.) L. sp.
 20 *Navicula amphioxys* Cleve
 21 *Pinnularia viridis* (Nitzsch) Ehr. var. *subulata* (H. Gr.) Hust.

PLATE 10

- FIG. 1 *Pinnularia nobilis* Ehr
 2 *Nitzschia squamulosa* (Ehr) W. Smith
 3 *Navicula cryptocommata* Kütz
 4 *Cymbella japonica* Reichelt
 5 *Navicula lanceolata* (Agardh) Kütz
 6 *Meiosira binderana* Kütz
 7 *Diatoma laevigatum* Bory var *hacaria* Grun
 8 *Gomphonema gracile* Ehr var *lancoolata* Kütz (Cleve)
 9 *Synedra japonica* Meister
 10 *Synedra lunata* Nitzsch Ehr var *dancea* (Kütz) Grun
 11 *Gomphonema lasiolepis* Hust. var *caerulea* var nov
 12 *Meiosira distans* (Ehr) Kütz var *avida* (Ehr) B. J. Greg.
 13 *Diatoma humile* (Lyngb.) Hervey
 14 *Cymbella Reinhardtii* Grun
 15 *Fragilaria costata* (Ehr) Grun var *nipponica* var nov
 16 *Navicula atenuata* (Nitzsch) Grun var *nipponica* var nov
 17 *Achnanthes linearis* W. Smith var *pusilla* Grun
 18 *Achnanthes lanceolata* (Broth) var *rostrata* Hust
 19 *Gomphonema subtile* Ehr var *angusta* Schum.
 20 *Navicula punctata* (Ehr) Grun fo *nipponica* fo nov
 21 *Eurhemia lebra* (Ehr) Kütz var *axonea* (Kütz) Grun
 22 *Synedra Goutardii* (Broth) Grun
 23 *Stauroneis Smithii* Grun var *nipponica* var nov
 24 *Synedra Terryana* Ward fo *mutata* fo nov
 25 *Diatoma humile* (Lyngb.) Hervey var *microdon* Ehr Grun
 26 *Pinnularia laevigata* Cleve
 27 *Achnanthes affinis* Grun var *humilis* var nov
 28 *Meridion crenulatum* Agardh var *costatella* (Ralfs) Van Heurck
 29 *Synedra uncinata* Meister var *nipponica* var nov
 30 *Stereopterobryon intermedium* (Lewis) fo *subtile* Frueh
 31 *Gomphonema quadripunctatum* (Orsted) W. Smith var *hastata* Wislouch
 32 *Fragilaria constans* Ehr Grun var *undulata* Reichelt
 33 *Cymbella novae-ratae* (Berkeley) Cleve

PLATE 11

- FIG. 1 *Cymbella japonica* Reichelt
 2 *Cymbella equata* W. Smith
 3 *Cymbella Ehrenbergii* Kütz
 4 *Cymbella heteroplicata* Ehr var *minor* Cleve
 5 *Cymbella gracilis* Kütz
 6 *Cymbella nascentium* A. S. S. S. S.
 7 *Cymbella japonica* Reichelt
 8 *Cymbella ventricosa* Kütz
 FIGS 9 and 10 *Cymbella affinis* Kütz
 FIG 11 *Navicula muticula* Grun
 12 *Achnanthes arida* (Kütz) Cleve var *nipponica* var nov
 13 *Cymbella heteroplicata* Ehr fo *nipponica* fo nov
 14 *Cymbella ventricosa* Kütz
 15 *Cymbella sinuata* Greg.

6. *Cymbella tamida* (Breb.) Van Heurck var. *borealis* Grun
7. *Cymbella tamida* Breb. Van Heurck
8. *Cymbella verrucosa* Ritt.
9. *Fragilaria conserta* (Ehr.) Grun var. *apiculata* Husted
10. *Cymbella furgida* Greg. Cleve
11. *Cymbella cymbiformis* (Agardh) Kütz. Van Heurck
12. *Navicula Pusio* Cleve
13. *Cymbella cuspidata* Kütz.
14. *Cymbella furgida* Grun
15. *Cymbella macrocephala* Grun.

PLATE 12

1. *Pinularia brevicornata* Cleve
2. *Cyclotella comita* Ehr. Kütz. var. *naucapiunctata* Grun
3. *Gomphonema nipponica* sp. nov.
4. *Gomphonema acuminatum* Ehr. var. *lunatum* (Ehr.) Cleve
5. *Gyrosigma scallorendes* (Kütz.) Cleve
6. *Opephora Okadae* sp. nov.
7. *Gomphonema lanceolatum* Ehr. var. *marginata* (Greg.) Cleve
8. *Opephora Mariae* Herib. var. *robusta* var. nov.
9. *Diptoneis margaretiata* Hust.
10. *Neidium dubium* (Ehr.) Cleve
11. *Pinularia mesolepta* (Ehr.) W. Smith
12. *Cymbella stipitata* Grun.
13. *Achnanthes lanceolata* Breb. var. *nipponica* var. nov.
14. *Synedra tenera* Greg. var. *punctata* var. nov.
15. *Navicula pupula* Kütz.
16. *Gomphonema Berggreni* Cleve
17. *Achnanthes Oestrupii* (A. Cleve) Hust.
18. *Pinicorneis vordae* (Nitzsch) Ehr. var. *lanceata* Cleve
19. *Neidium kauloi* Mevesch. var. *nipponica* var. nov.
20. *Fragilaria viridula* Ralfs var. *adipiscens* Hust. fo. *nipponica* fo. nov.
21. *Fragilaria pinnata* Ehr.
22. *Cymbella gracilis* (Rabh.) Cleve fo. *minor* fo. nov.
23. *Navicula septentrionalis* Oestr.
24. *Pinularia divergentissima* Grun
25. *Elliptia praecepta* Ehr.
26. *Achnanthes Hauckiana* Grun.

PLATE 13

1. *Nitzschia interrupta* Kütz. Hust.
2. *Nitzschia ovata* Kütz. W. Smith var. *temerontas* Grun
3. *Opephora Mariae* Herib.
4. *Synedra ovalis* Breb. var. *nipponica* var. nov.
5. *Gomphonema castum* Hust.
- 6 and 7. *Gomphonema linguatum* Hust.
8. *Gomphonema acuminatum* Ehr. var. *coronata* Ehr. W. Smith
9. *Gomphonema parvum* Kütz. Grun var. *micropus* (Kütz.) Cleve
10. *Opephora Mariae* Herib. var. *robusta* var. nov.

- FIG. 11. *Hantzschia amphioxys* (Ehr.) Grun.
 12. *Opephora Martyi* Herib. var. *elongata* var. nov.
 13. *Gomphonema constrictum* Ehr.
 14. *Gomphonema intricatum* Kütz.
 15. *Nitzschia communis* Rabh.
 16. *Gomphonema parvulum* (Kütz.) Grun.
 FIGS. 17 and 18. *Nitzschia dissipata* (Kütz.) Grun.
 FIG. 19. *Nitzschia pulca* (Kütz.) W. Smith.
 20. *Gomphonema constrictum* Ehr.
 21. *Gomphonema parvulum* (Kütz.) Grun. var. *exilisimum* Grun.
 22. *Gomphonema olivaceum* (Lyngb.) Kütz.
 23. *Gomphonema constrictum* Ehr. var. *capitata* (Ehr.) Cleve
 24. *Gomphonema nipponica* sp. nov.
 25. *Nitzschia recta* Hantzsch.
 26. *Nitzschia dissipata* (Kütz.) Grun.
 27. *Nitzschia acicularis* W. Smith var. *nipponica* var. nov.
 28. *Nitzschia pulca* (Kütz.) W. Smith.
 29. *Nitzschia pulva* Norman?
 30. *Nitzschia capitellata* Hust. var. *nipponica* var. nov.
 31. *Gomphonema augur* Ehr.
 32. *Gomphonema lanceolatum* Ehr. var. *tasiguis* (Greg.) Cleve
 33. *Gomphonema vastum* Hust. var. *elongata* var. nov.
 34. *Gomphonema parvulum* (Kütz.) Grun.
 35. *Nitzschia fonticola* Grun.
 36. *Gomphonema parvulum* (Kütz.) Grun. var. *micropus* (Kütz.)
 Cleve fo. *nipponica* fo. nov.
 37. *Synedra cyclopus* Brutschi var. *nipponica* var. nov.
 38. *Gomphonema acuminatum* Ehr.
 39. *Gomphonema olivaceum* (Lyngb.) Kütz. var. *minutissimum* Hust.
 40. *Gomphonema vastum* Hust. var. *elongata* var. nov.
 41. *Gomphonema intricatum* Kütz.
 42. *Gomphonema abbreviatum* Agardh? Kütz.

PLATE 14

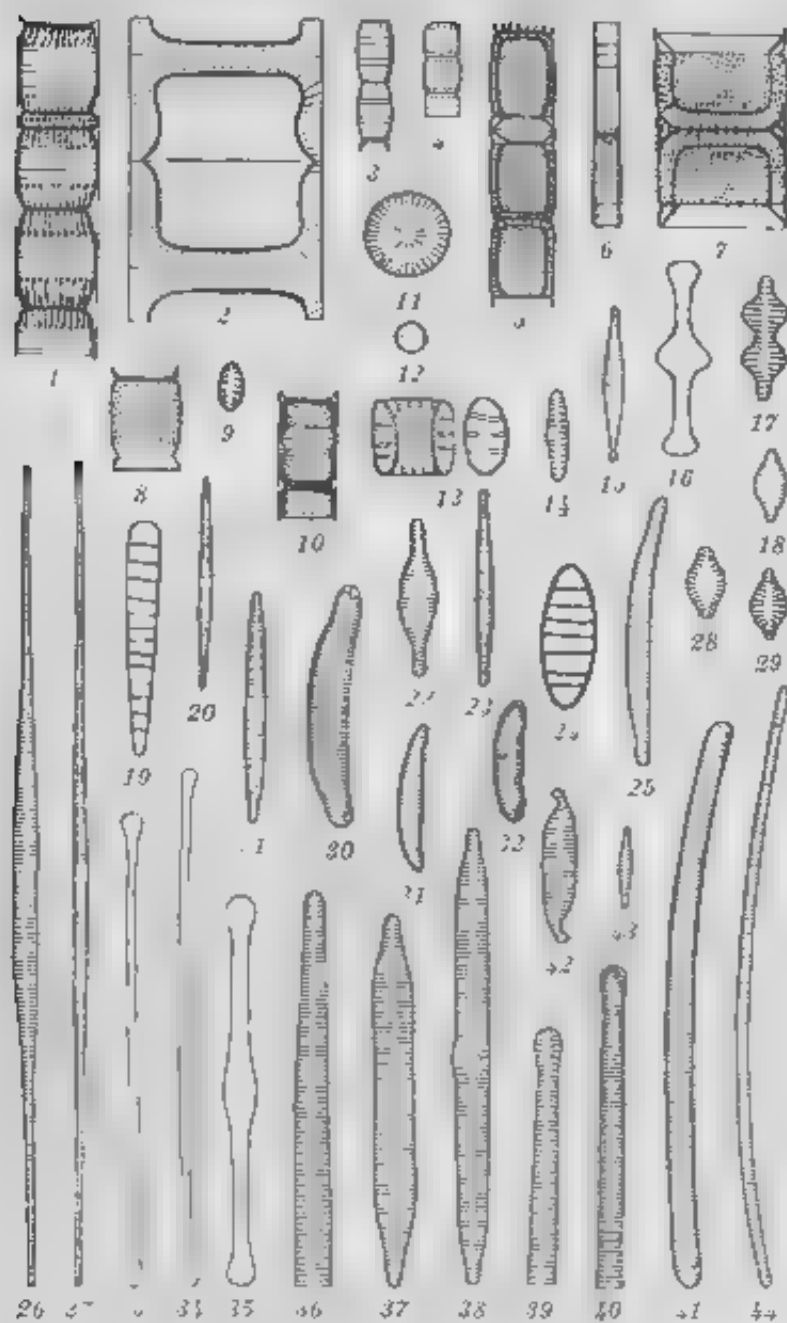
- FIG. 1. *Cymatopleura elliptica* (Breb.) W. Smith.
 2. *Diplanxira oculata* (Breb.) Cleve var. *nipponica* var. nov.
 3. *Surirella robusta* Ehr. var. *splendida* (Ehr.) Van Heurck.
 4. *Euxetia jaba* (Ehr.) Grun. var. *nipponica* var. nov.
 5. *Surirella Caproni* Breb. var. *obtusata* Hust.
 6. *Ackmannthes Hauckiana* Grun. var. *elliptica* Schulz. fo. *nipponica*
 fo. nov.
 7. *Surirella linearis* W. Smith var. *constricta* (Ehr.) Grun.
 8. *Fragilaria Harrisoni* W. Smith var. *rhomboides* Grun.
 9. *Fragilaria brevistriata* Grun.
 10. *Euxetia pectinifolia* (Kütz.) Rabh. var. *minor* (Kütz.) Rabh. fo.
impressa (Ehr.).
 11. *Surirella laterata* Breb. var. *nipponica* var. nov.
 12. *Surirella hirsuta* Breb.
 13. *Surirella tenera* Greg.
 14. *Surirella biseriala* Breb. var. *constricta* Grun. fo. *privata* fo.
 nov.
 15. *Surirella tenera* Greg. var. *sericea* A. Schaudt.

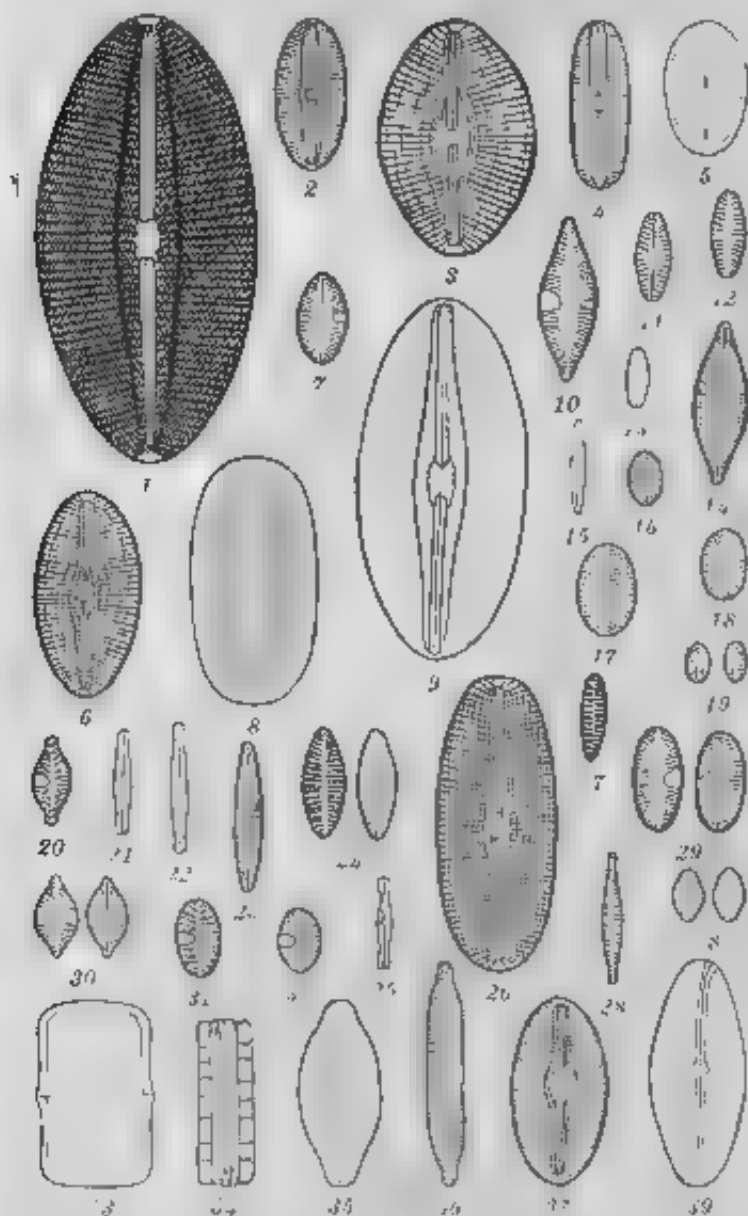
PLATE 15

- FIG. 1 *Surirella biseriata* Breh var *bifrons* (Ehr) Hust fo. *uspidata* fo. nov
 2 *Surirella Terryana* Ward var *nipponica* var nov
 3 *Surirella biseriata* Breh var *nipponica* fo. *punctata* fo. nov
 4 *Surirella elegans* Ehr fo. *elongata* fo. nov
 5 *Nauicula mutica* Kütz
 6 *Cymatopleura setica* (Breb) W Smith var *gracilis* Grun.
 7 *Cymatopleura setica* (Breb) W Smith var *regua* (Ehr) Grun.
 8 *Surirella linearis* W Smith var *nipponica* var nov. fo. *constricta* fo. nov
 9 *Surirella linearis* W Smith var *nipponica* var nov
 10 *Cymbella Kawanura* sp. nov
 11 *Surirella linearis* W Smith
 12 *Epithemia borex* Kütz
 13 *Surirella Terryana* Ward fo. *minuta* fo. nov

PLATE 16

- FIG. 1 *Surirella robusta* Ehr var *splendida* (Ehr) Van Heurck fo. *constricta* Hust
 2 *Surirella robusta* Ehr var *splendida* Ehr, Van Heurck fo. *punctata* Hust
 3 *Surirella linearis* W Smith var *apiculata* var nov
 4 *Surirella Caproni* Breb. var *obtusa* Hust fo. *capitata* fo. nov
 5 *Fragilaria Harrisoni* W Smith
 6 *Fragilaria Harrisoni* W Smith var. *divisa* Grun
Fragilaria brevistriata Grun var *nipponica* var nov.
 7 *Surirella linearis* W Smith var *helvetica* (Brun) Mesner
 8 *Fragilaria constricta* (Ehr) Grun var *boodis* (Ehr) Grun
 9 *Surirella robusta* Ehr fo. *lata* Hust
 10 *Surirella Terryana* Ward
 11 *Nauicula kizakiensis* sp. nov
 12 *Fragilaria construens* (Ehr) Grun var *nipponica* var nov
 13 *Pinnularia Balfouriana* Grun var *stauroptera* var nov
 14 *Pinnularia borea* s Ehr





PLATE

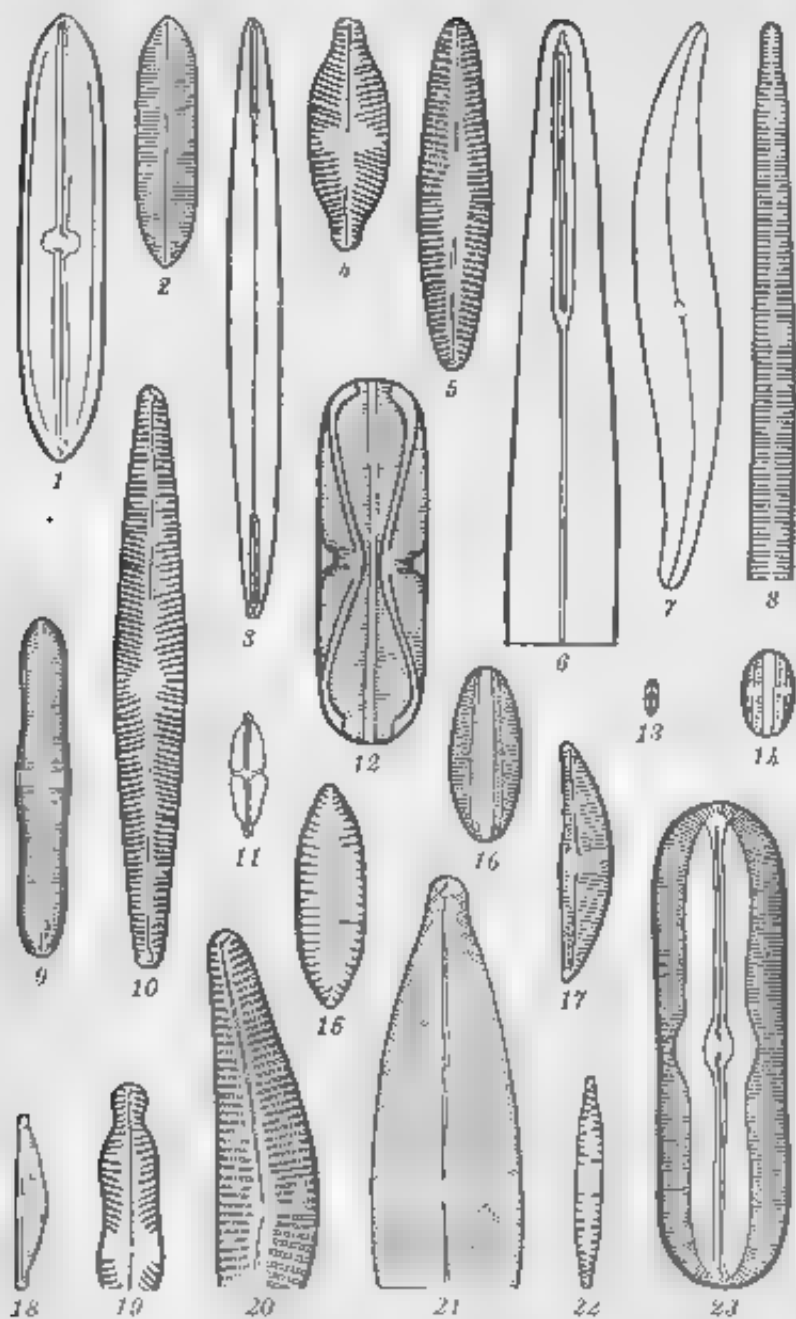


PLATE 3

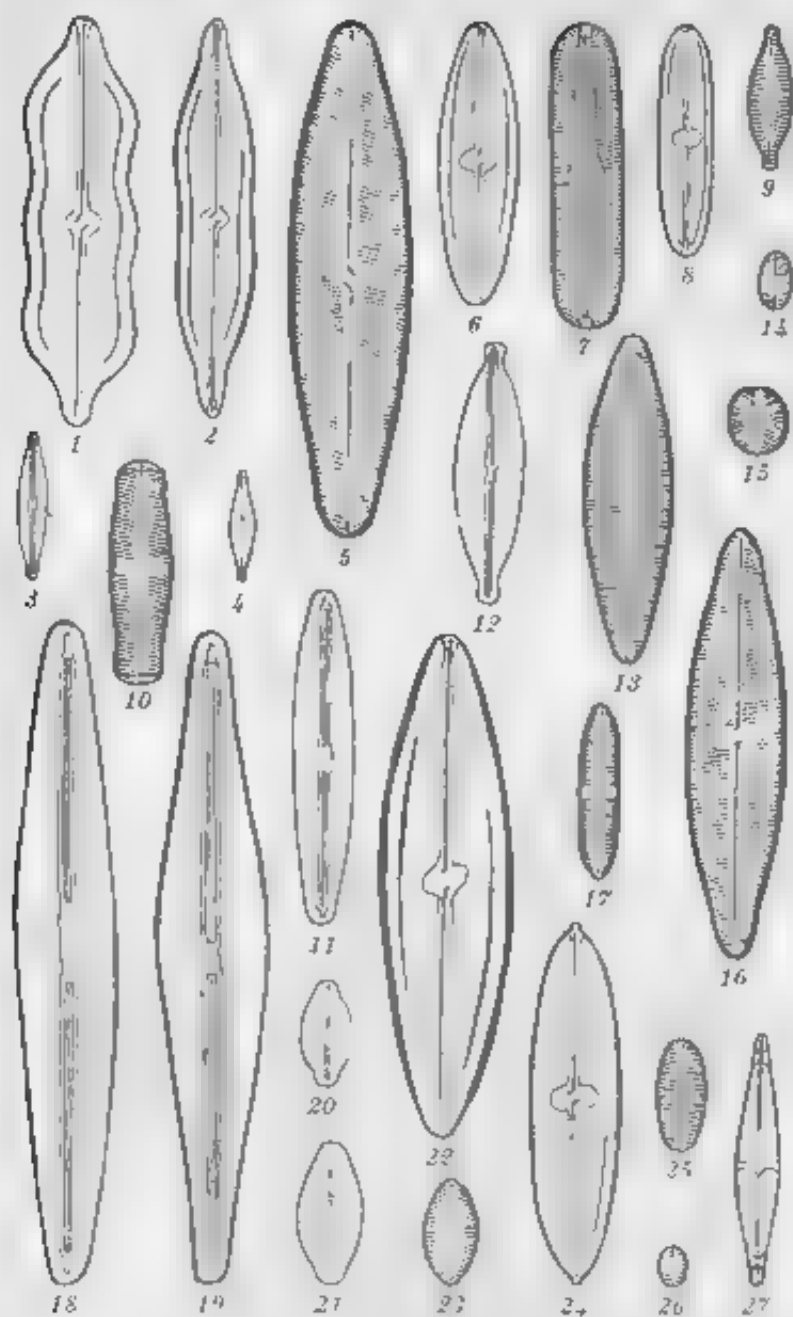


PLATE 4

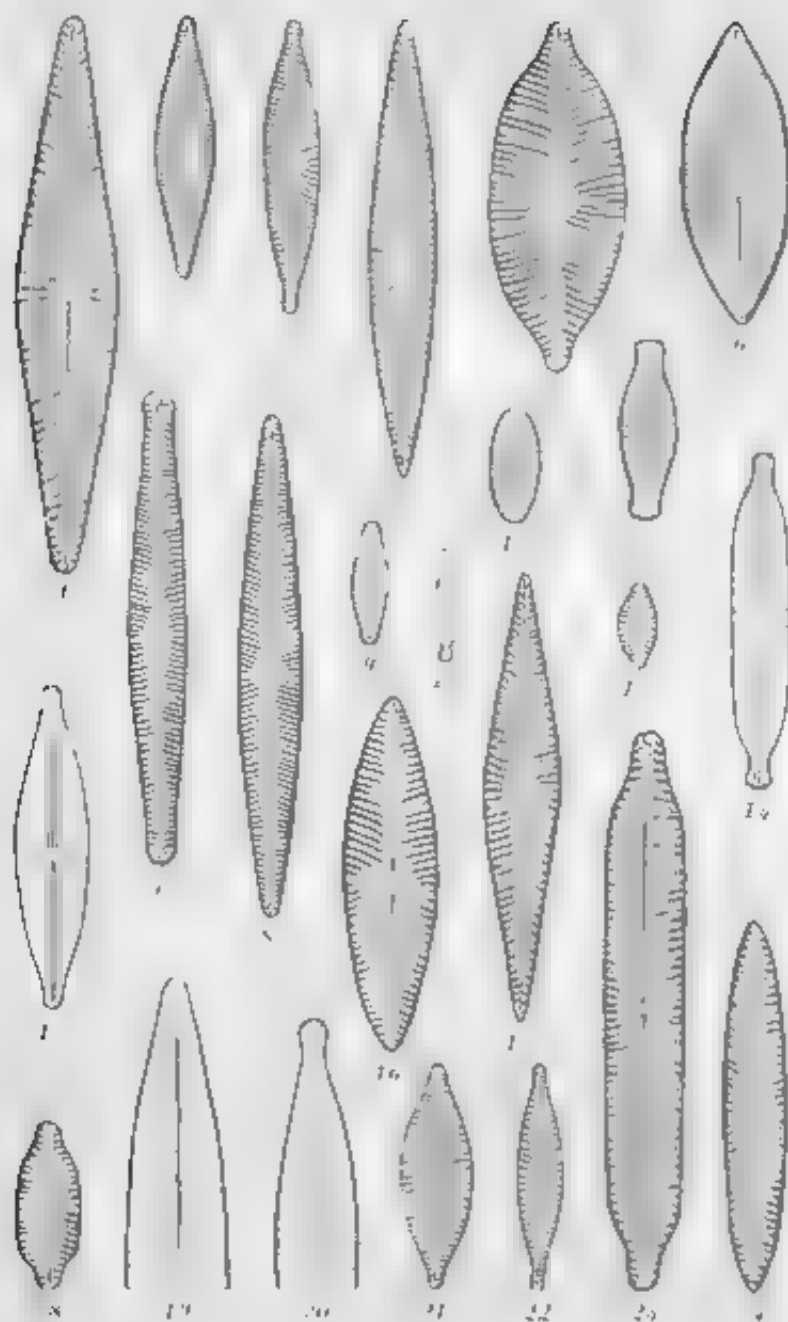


PLATE 3

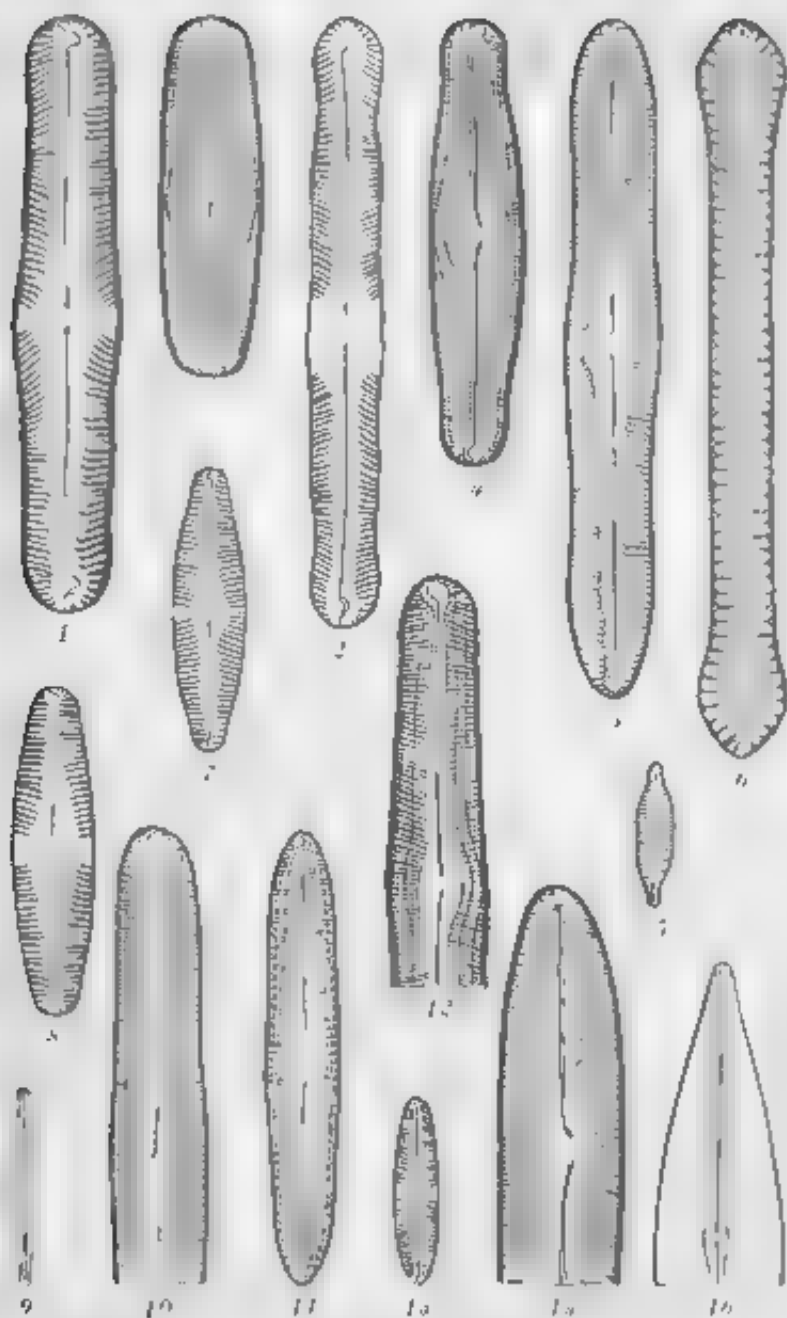


PLATE 8



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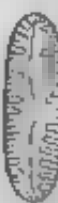
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11



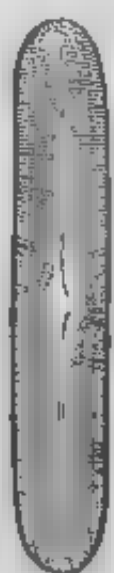
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14



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16

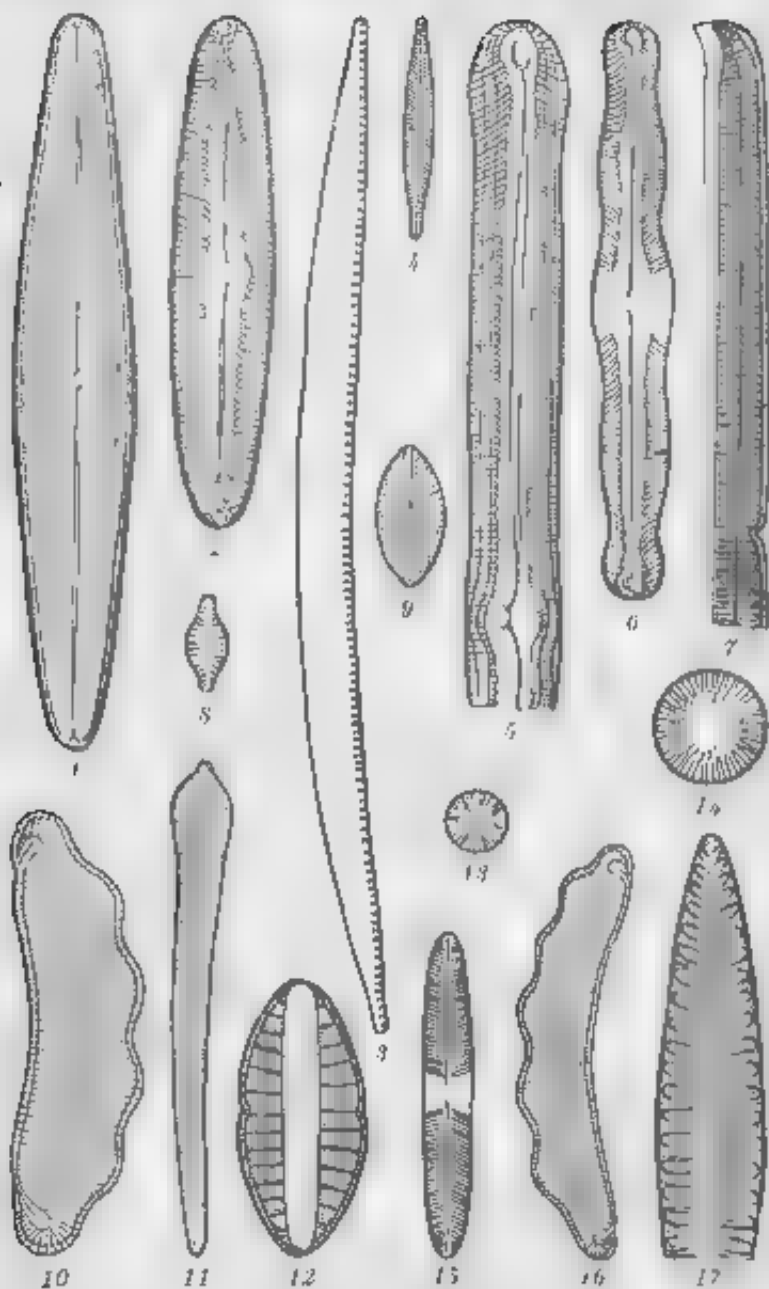


PLATE 8

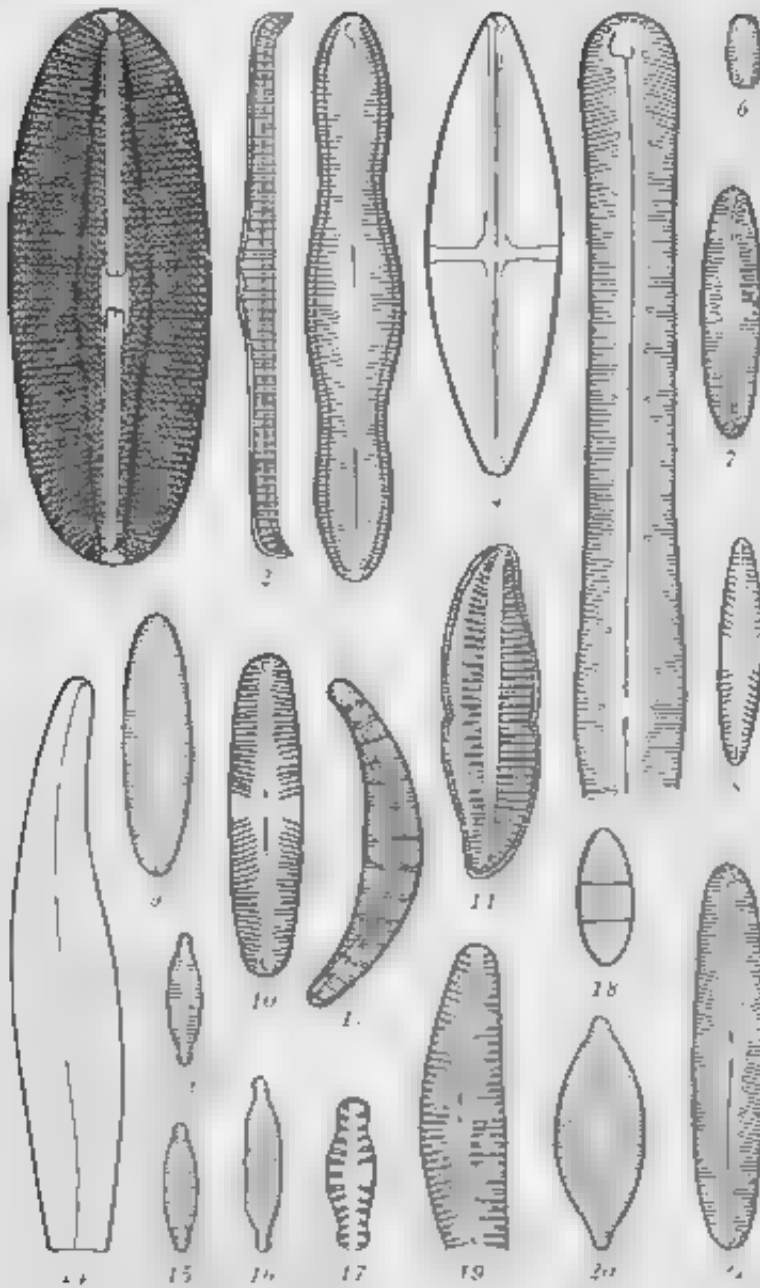


PLATE 3.

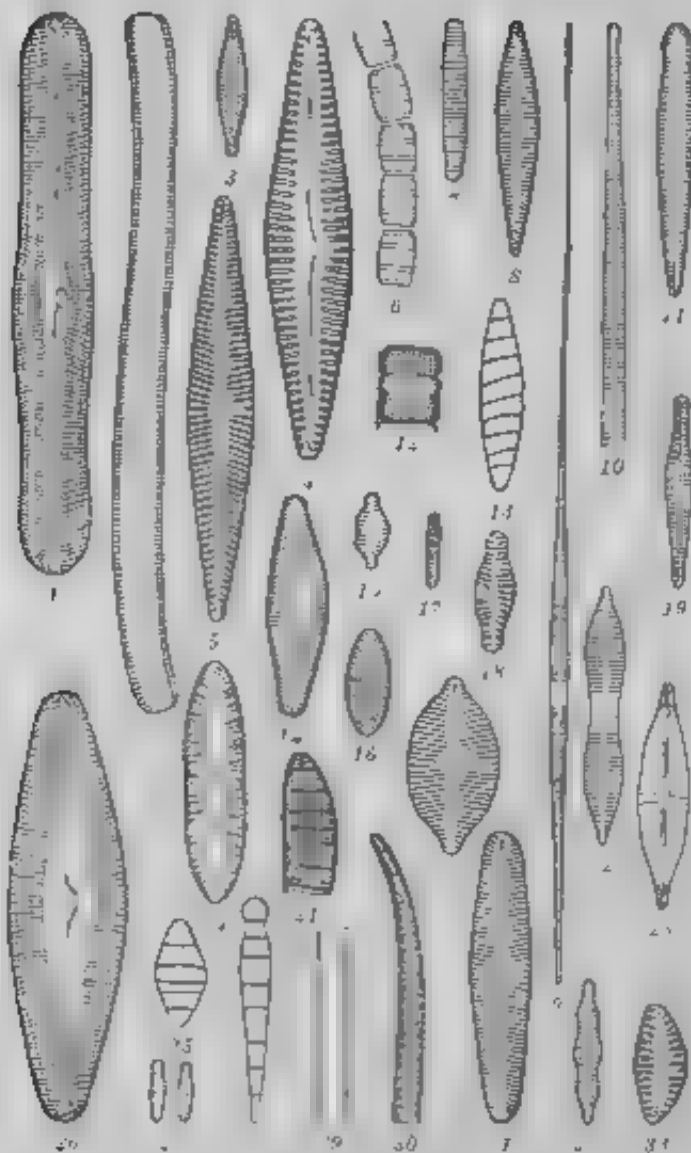
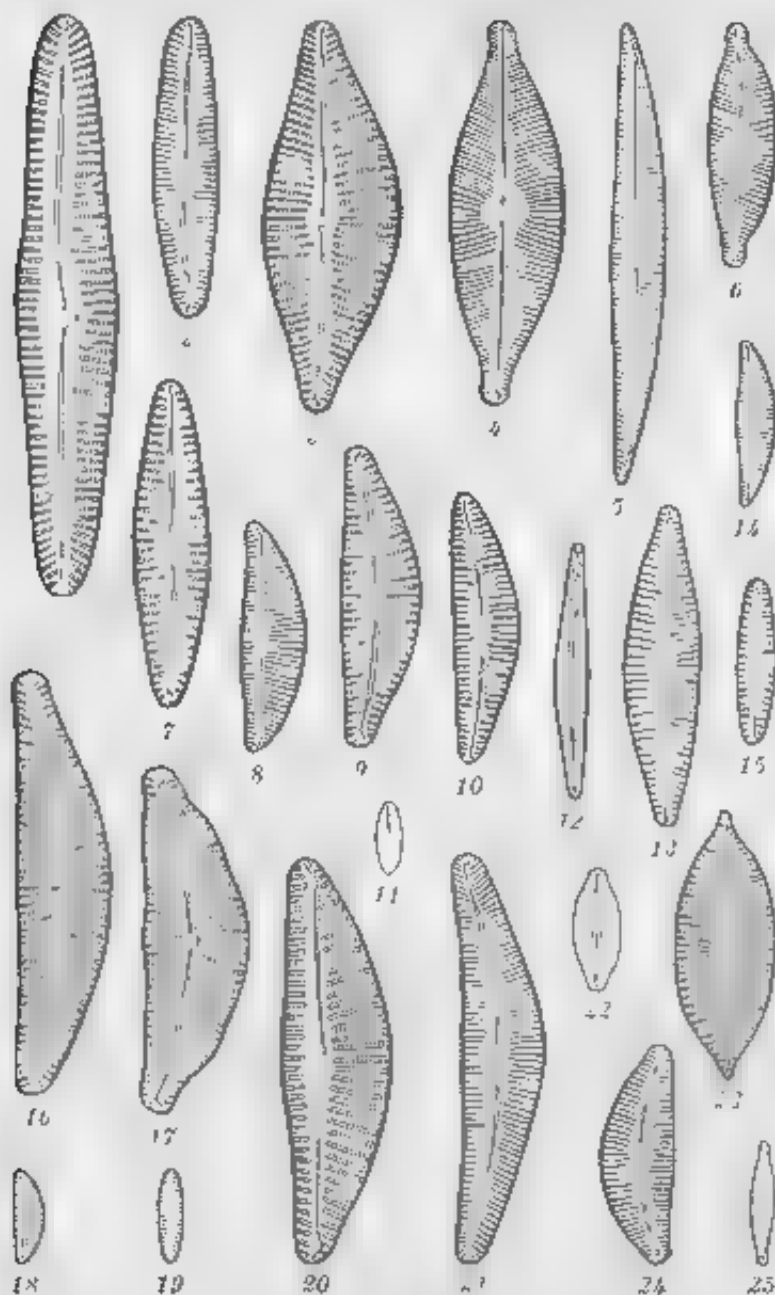
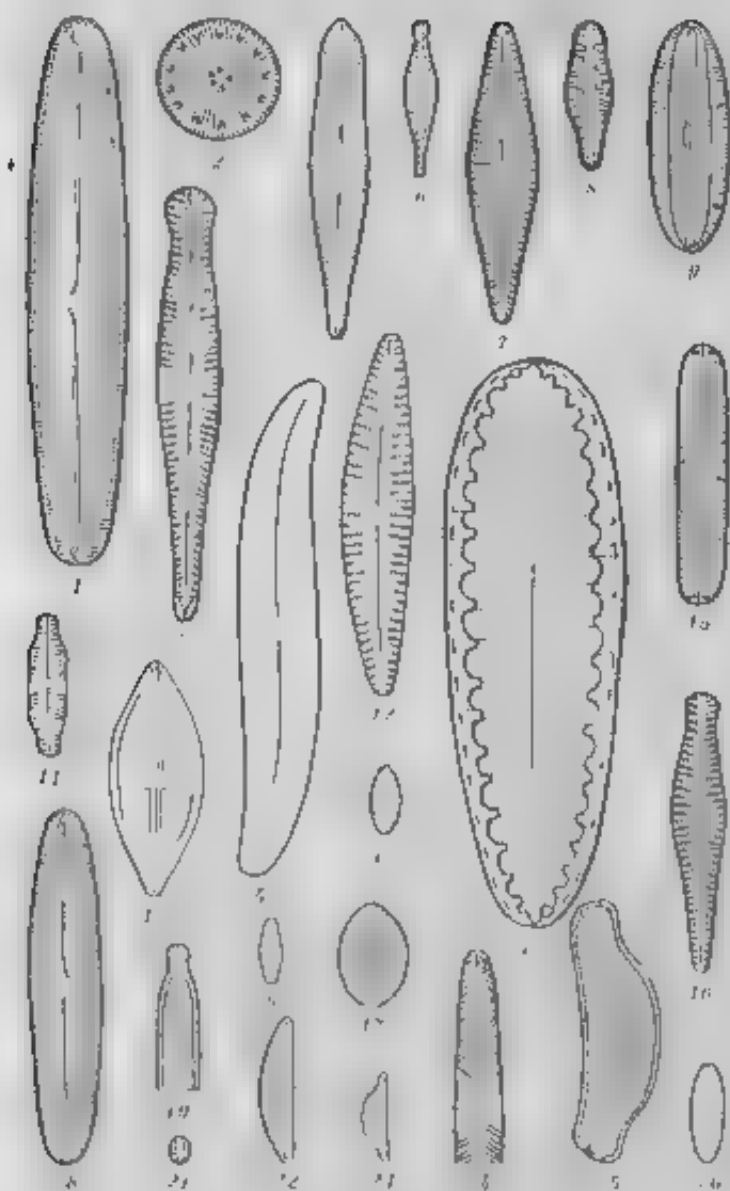


PLATE 9



PLATE



PLATE

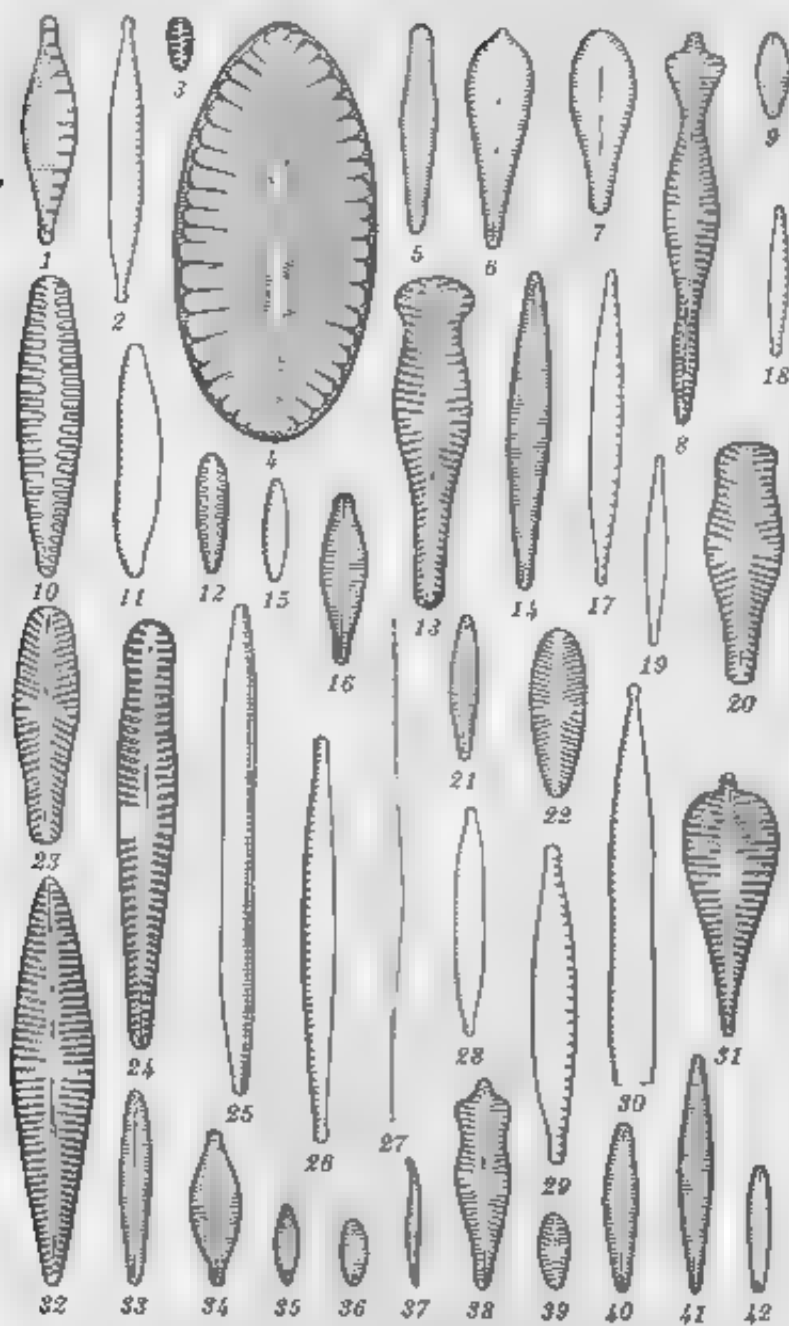


PLATE IV

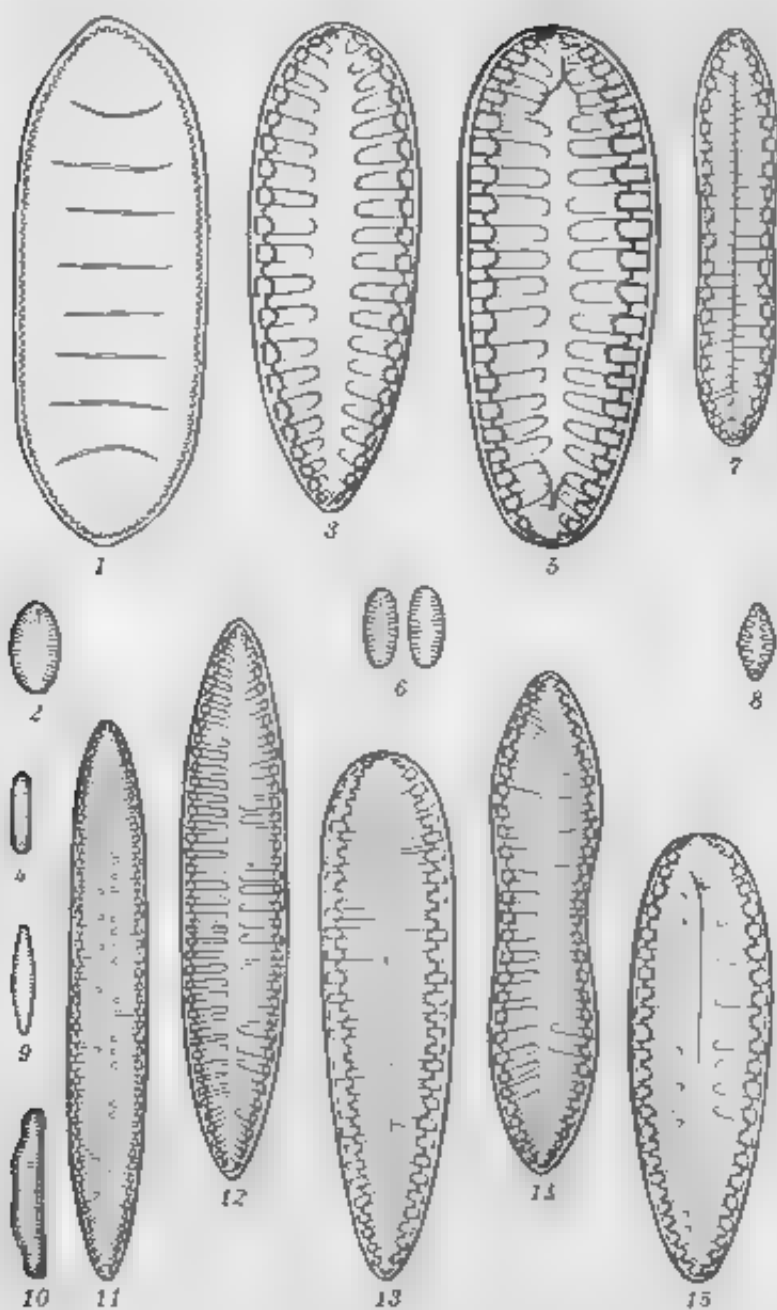


PLATE 4

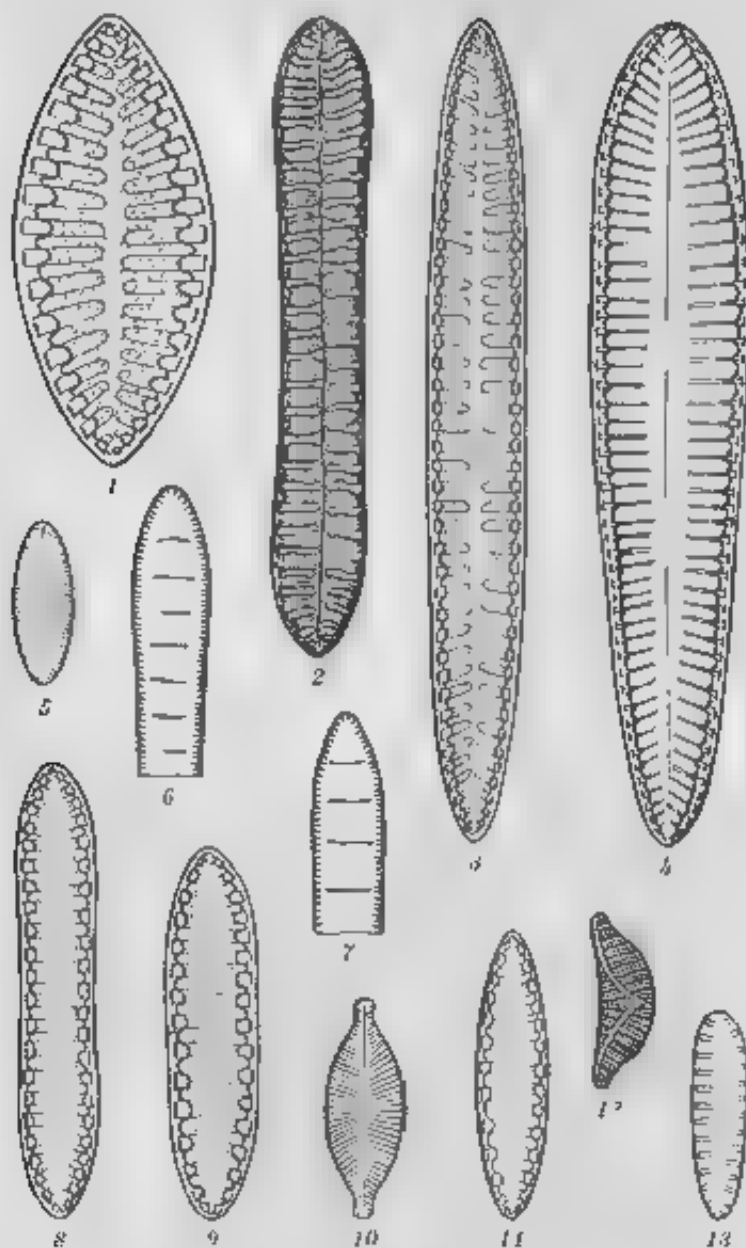


PLATE 15.

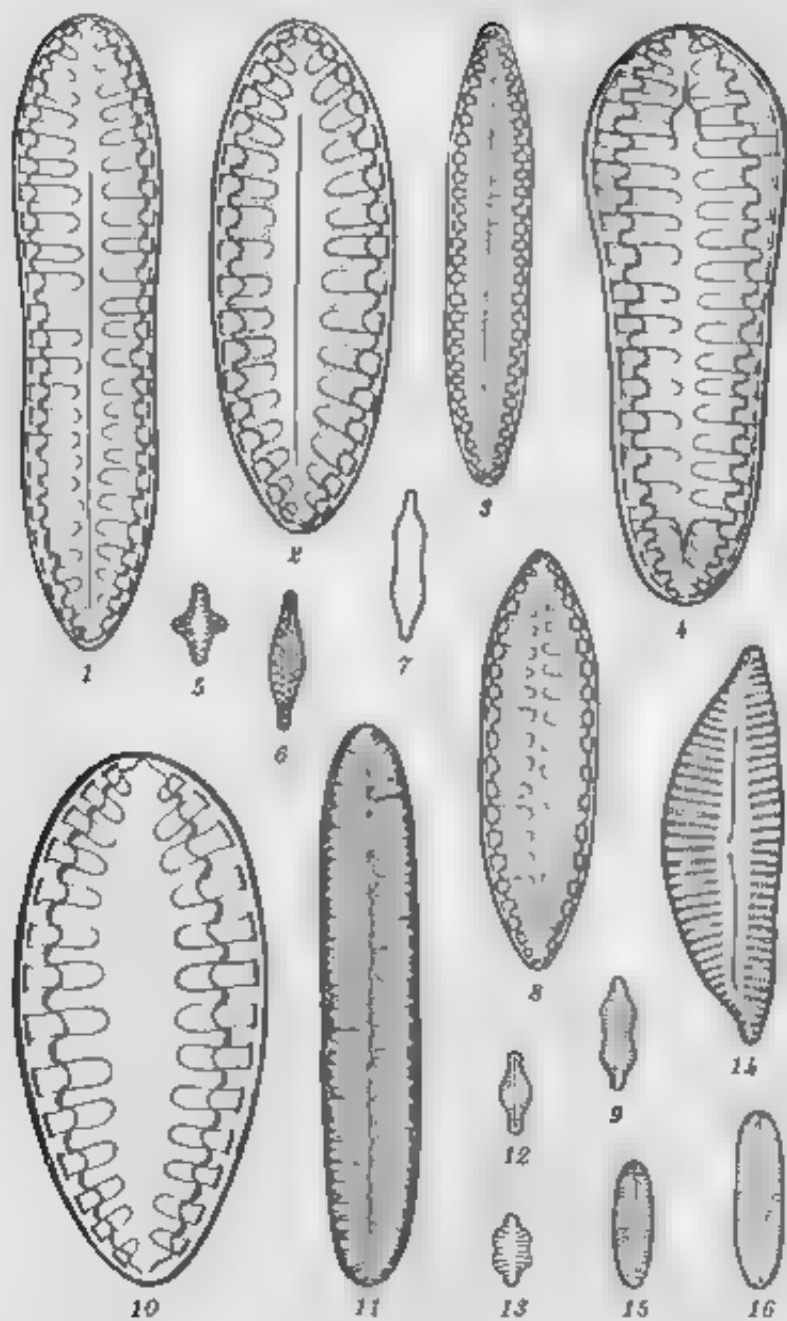


PLATE 15.

OÖCHORISTICA EXCELSA, A NEW REPTILIAN CESTODE

By MARCOS A. TIMANEY and VICTORIA A. MARIANES
Of the Bureau of Science, Manila

ONE TEXT FIGURE

Two specimens of a new tapeworm were found in the intestine of a grass lizard, *Alcobius multifasciatus*. Unfortunately, the head and neck are lacking in one of the specimens, for which reason a comparative study could not be made of these structures.

According to Meggitt (1934), the genus *Oöchoristica* (Luehe, 1898) includes twenty five valid species, the other forms that have been described under the genus being either synonyms or members of closely related cestode genera. To these the following have recently been added: *Oöchoristica pygmaea*, described by Birt (1933) from a lizard, *Lugosoma punctatum*, caught in Colombo, Ceylon; *O. thapari*, described by Johri (1934) from an Indian lizard, *Calotes* sp. and *O. taborensis* found by Joenen (1934) in the intestine of a bat in Kansas, United States. Compared with these known species and considering, according to Meggitt the course of the genital ducts, the extent of the cirrus sac across the proglottis, and the arrangement of the testes as important characters in differentiating between the members of the genus, the Philippine parasite appears to bear the closest resemblance to *O. sarinawana* (Cohn, 1902), *O. abraia* Meggitt, 1927 and *O. americana* Hardwood, 1932. It may be distinguished, however, from these three species by the small dimensions of its body, head, and cirrus pouch, its fewer testes, and the oval shape of the lobes of its ovary.

OÖCHORISTICA EXCELSA sp. nov. Text fig. 1

Description.—Maximum length about 28 millimeters. Immature and mature segments much wider than long, gravid segments squarish but usually much longer than wide. Extreme measurements of available material gave the following results: immature segments 0.030 to 0.072 by 0.24 to 0.35, mature segments 0.095 to 0.247 by 0.38 to 0.62, gravid segments 1.9 to 4.7 by 0.55 to 1.1 millimeters. Scolex unarmed, 0.25 millimeter in diameter, separated from the rest of the worm by a very

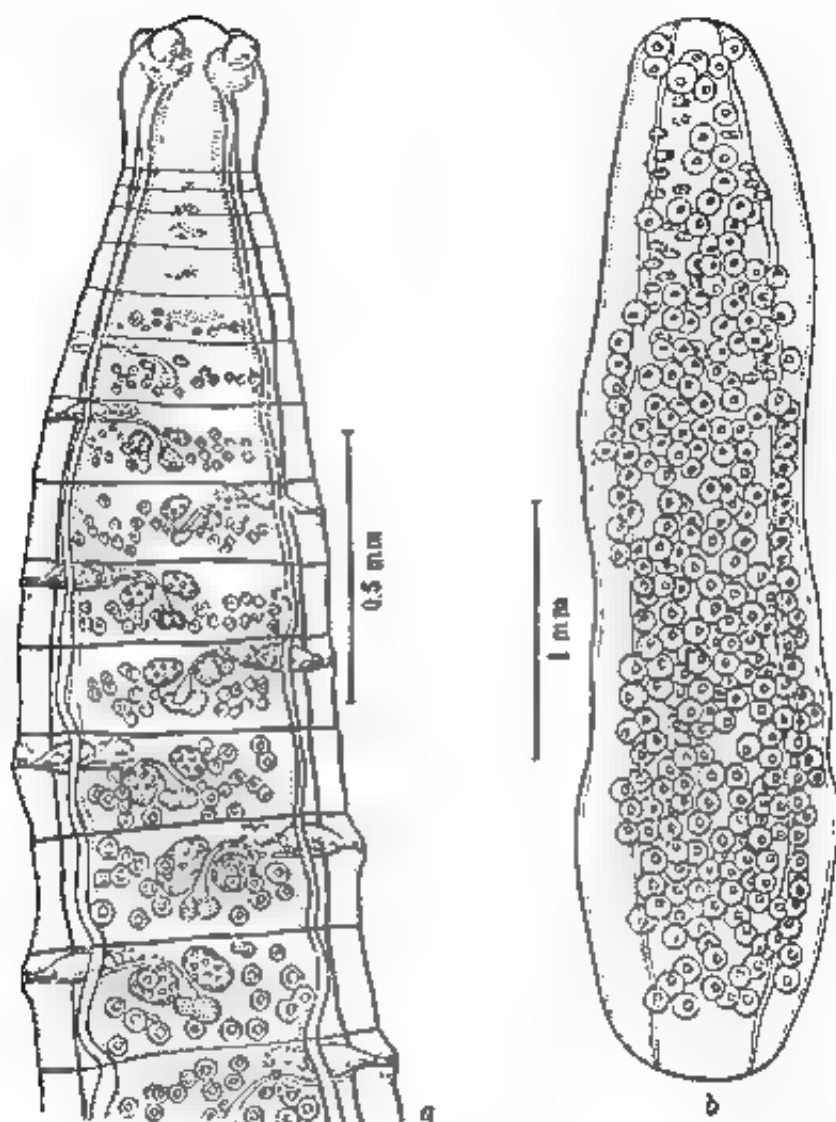


FIG. 1. *Ockleria exilis* sp. nov. a, anterior end of worm showing suckers and minute tentacles. b, a gravid segment.

short neck. Suckers 0.075 to 0.088 millimeter in diameter. Genital pores irregularly alternate, situated at posterior border of first third of lateral margins of mature proglottids; in gravid segments they occur at limit of anterior fourth or fifth of

margins. Genital cloaca absent. Genital ducts pass between principal longitudinal excretory vessels.

Male reproductive organs appear to attain maturity before those of the female genital system. Testes spherical, 23 to 29 in number, 19 to 30 microns in diameter at posterior half of proglottis and extending anteriorly on both sides of median line to middle level of ovary; they are confined between longitudinal excretory vessels. Cirrus sac oval 0.107 to 0.123 by 0.046 to 0.057 millimeter in size. In mature segments the cirrus sac extends mesially well past the longitudinal excretory vessels, while in gravid segments it does not pass beyond these vessels. Vas deferens short, in loose coils.

Ovary bilobed, immediately preequatorial, displaced slightly towards oral side of segment, lobes oval, 0.030 to 0.073 by 0.050 to 0.086 millimeter in size. Vitelline gland median, composed of two wings, 0.053 to 0.084 millimeter across, immediately behind ovary. Shell gland small, between ovary and vitelline gland. Vagina opens into genital pore behind cirrus. A distinct receptaculum seminis present. Uterine sacs are first seen in seventh or twelfth segment; a fully developed gravid segment contains at least 250 of these sacs or capsules, each enclosing a single ovum. Uterine capsules 84 to 107 microns in diameter, onchospheres 38 to 46 by 30 to 34 microns in size, and the embryonal hooks about 19 microns in length.

Specific diagnosis.—Obchovutia. Maximum length 26, maximum breadth 1.1 millimeters. Scolex 0.23 millimeter across. Genital pores irregularly alternate, at limit of anterior third of lateral margins of mature segments, in gravid proglottids at limit of anterior fourth or fifth of margins. Genital cloaca absent. Cirrus sac 0.107 to 0.123 by 0.046 to 0.057 millimeter in size, in mature proglottids half-crossing longitudinal excretory vessels, in gravid segments extending only to vessels. Testes 23 to 29 in number, 19 to 30 microns in diameter, reaching anteriorly to middle level of ovary. Uterine capsules 84 to 107 microns in diameter, onchospheres 38 to 46 by 30 to 34 microns in size, embryonal hooks 19 microns in length.

Host.—Grass lizard, *Mabania multifasciata*.

Location.—Intestine.

Locality.—Los Baños, Laguna Province, Luzon.

Type specimens.—Philippine Bureau of Science parasitological collection, No. 506.

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ILLUSTRATION

TEXT FIGURE

FIG. 1. *Oöcherastrea ezzeles* sp. nov., a, anterior end of worm showing
notch and mature segments, b, a gravid segment.

DIE STAPHYLINIDEN DER PHILIPPINEN (GATTUNG OXYTELUS)¹

Von MAX REICHENOW

Off. östlicher Natur in Horn. Nieder-Oesterreich

Uebersicht über die philippinischen Arten der Gattung *Oxytelus*

- 1 Erstes Fühlerglied gegen die Spitze nicht erweitert 2
Erstes Fühlerglied gegen die Spitze wenig erweitert 3
- 2 Augen fein facettiert. Untergattung *Tenysomus* 7
Augen grob facettiert. Untergattung *Carcoporus* 1
- 3 Halsschild mit deutlichen Längsfurchen 4
Halsschild fast ohne Andeutung von Furchen. Färbung rotlichgelb, glänzend, fast anischaart. Kopf so breit wie der Halsschild, mit sehr grossem, fast die ganzen Kopfseiten einnehmenden ziemlich fein facettierten Augen, fein und weitläufig punktiert ohne deutliche Eindrucke. Küsscheln fast so breit wie die Flügeldecken, fast um die Hälfte breiter als lang nach vordwärts gerundet, etwas aus der Mitte verengt, längs der Mitte mit einer sehr feinen, undeutlichen Längsfurche, an den Seiten schwach nach vordwärts, fein und weitläufig, an den Enden etwas dichter punktiert. Flügeldecken etwas länger als der Halsschild, fein und wenig dicht, etwas längsrig punktiert. Abdomen fast unpunktirt. Länge 2,5 mm.
Manila *agathos* sp. nov.
- 4 Die seitlichen Längseindrücke des Halsschildes lang scharf und tief die Mitte erreichend. Eindruck sehr tief und schmal. Molukken, Philippinen, Neu-Britannien *fulvus* Fairv.
Die seitlichen Längseindrücke des Halsschildes mehr oder minder flach und undeutlich 5
- 5 Hinterleib mit durchgehender schwarzer Mittellinie. Halsschild klein schmal. Java *capitatus* Fairv.
Hinterleib ohne schwarze Mittellinie 6
- 6 Körper grosser Halsschild ziemlich mit dicht längs gerunzelt. Über die indomalaysische Region weit verbreitet *agathos* Fairv.
Körper kleiner. Halsschild glänzend, ziemlich weitläufig punktiert kaum angestreicht. Fast über die ganzen Tropen mit Ausnahme der afrikanischen Festländer verbreitet *fulvus* Fairv.
- 7 Körper klein, Färbung tiefschwarz mit hellgelben Flügeldecken. Halsschild an den Seiten ziemlich gleichmässig gerundet mit abgerundeten Hinterecken. Über den grossen Teil der indomalaysischen und afrikanischen Region und Madagaskar verbreitet *agathos* Fairv.
Körper grosser. Halsschild mitge, nach vordwärts weit und mehr gerundet verengt mit sehr tiefen schwarzen Furchen *megacephalus* var. *fulvus* Fairv.

12 Beitrag zur indomalaysischen Staphyliniden-Fauna

- | | | | | | |
|--|-------|-------|-------|-------|-----|
| B. Kopf beim Mannchen mit zwei Stacheln am Vorderrand (Unter-
gattung <i>Harporhina</i> Lat.) | | | | | 28. |
| Kopf beim Mannchen am Vorderrand ohne Stacheln | | | | | 9 |

- * Kurzwandlung der Bl. zuweilen durch eine kräftige scharfe Längsfalte von der Herabgezogenen Seiten begrenzt, Augen klein, farnicht (Interpretation *Stenopogon*)

Körper ziemlich gross, Halsbald fast mehr als doppelt so breit wie lang, lebhaft rotzitrin, der Kopf schwarz, die Flügeldecken geschwärzt, in sehr seltenen Fällen auch die Tergite an der Basis mehr oder minder schwach geschwärzt, das Fühler rötlichbraun, Kopf beim Männchen fast so breit wie der Halsbald, beim Weibchen viel schmäler, stark quer vorn unten eingedrückt, glänzend, hinten konvex und dunkel, beim Männchen lang gestreckt, beim Weibchen mehr rundeckig, punktiert, die Behaarung beim Männchen nach vornwärts erweitert, viel länger als die Augen, beim Weibchen viel kürzer, nach hinten stark erweitert, Fühler gegen die Spitze häufig verengt, das vierte und fünfte Glied länger als die folgenden eins verhältnissmässig klein, das vierte und fünfte um die Hälfte breiter als lang, das Halsbald fast stets doppelt so breit wie lang, mit drei tiefen Längsfurken und einem breiten Seitenrande, ganzlich kahl und ziemlich weit über punktiert glänzend, Flügeldecken etwas länger als der Halsbald, ziemlich stark und massig dachförmig, hinten etwas langgestreckt, punktiert, hinter ab fast unkenntlich, Länge 4 bis 8 mm. Luzon, Los Baños, Mindanao, Surigao und Morong.

ALFRED H. MANN, JR., PRES.

- | | | |
|----|--|----|
| 10 | Wachsfarbe der Flügeldecken ohne oder nur mit schwacher Kanten-
aufhellung. (Unterartung <i>Annularis</i>) | 10 |
| 10 | Vorderkörper mehr oder minder glänzend und groß skulptiert. Grund-
färbung hell | 11 |
| | Vorderkörper mehr oder weniger matt, glänzend fein skulptiert, Grund-
färbung meist schwarz | 20 |
| 11 | Malschild mehr oder weniger auf der Mitte mit einer oder zwei dunklen
Punkten | 12 |
| | Malschild nicht punktiert oder gestrichelt | 17 |
| 12 | Fühlerglieder mittel und ohne wellenförmige Punktation. Körper glänzend,
3 x 4 mm | 13 |
| | Fühlerglieder mittel und ohne wellenförmige Punktation. Körper glänzend,
3 x 4 mm | 13 |
| 13 | Körper glänzend (3 mm) Kopf rötlich, nicht charakterisiert | 13 |

referred from the 1974

- Kopf des (1 bis 2 mm) Kopf wachsenden bzw. Männchen teilweise matt eingeringelt
- 10 Kopf beim Männchen sehr stark gewölbt, zwischen den Augen annähernd flach und ganz matt eingeringelt ohne deutliche Punktierung, beim Weibchen glänzend, viel schwächer als der Malachitbl. Einfache rufschwarze, mit etwas dunklerem Kopf. Fühler ziemlich gestreckt, die vorletzten Glieder schwach 9-er. Halbschild von mehr als der Hälfte breiter als lang, verkehrt trapezförmig mit drei tiefen Längsfurchen und je einem leichten Seiteneindruck. Etwas kräftiger und weniger dicht strukturiert, glänzend. Flügeldecken etwas länger als das Halbschild, kraftig und recht unregelmäßig, wenig glänzend. Länge 15 bis 25 mm. Mitzima Bubana Luzon Mount Mansalaya Mos

- 25 Halbschild ist um ein Drittel breiter als lang. 26
 Halbschild um die Hälfte breiter als lang. Rückengroß, matt, die
 Flügeldecken etwas dunkler. Kopf beim Männchen so breit wie der
 Halbschild, mit langen Schläfen nach hinten etwas erweitert, amoral
 nicht chagriniert, beim Weibchen schmaler als der Halbschild, Schläfen
 kürzer. Halbschild vertieft trapezförmig, amoral d. rht. matt chag-
 riniert. Flügeldecken wenig länger als der Halbschild, ebenso dicht
 wie dieser aber stärker eingestrichelt. Länge 1.5 bis 2 mm. Luzon
 Mount Maquing. Mindoro San Teodoro. *hispidus* sp. nov.
- 26 Hypopygium nicht glänzend, wie der übrige Kopf matt. 27
 Hypopygium mehr oder minder glänzend. 27
- 27 Körner sehr kurz bis wechbraun, Flügeldecken gebändert punctiert

minutus Gyll.
 Körper mit rötlich gelben Flügeldecken dicht eingestrichelt. Fühler, Taster
 und Beine etwas blässer. Kopf schmaler als der Halbschild (Weib-
 chen) mit Ausnahme des Hypopygiums matt chagriniert. Halbschild ver-
 tieft trapezförmig, etwas mehr als ein Drittel breiter als lang, matt
 chagriniert, die drei Mittelfurchen ziemlich scharf, amoral be-
 sonderlich deutlich. Flügeldecken dunkler als der Halbschild, dicht
 und deutlich eingestrichelt. Länge kaum 1 mm. Luzon Los Baños,
 ein einziges Weibchen. *hispidus* sp. nov.

- 28 Vorderkörper matt. 29
 Vorderkörper mehr oder minder glänzend. 30
- 29 Vorderkörper vollkommen glänzend, Halbschild ohne Ansetzung einer
 Mittelfurche, die Stacheln am Vorderrand der Beine beim Männchen
 an der Spitze nach auswärts geschwungen. Schwanzbein, die
 Wurzel der gebürsteten Fühler und der Mund dunkler als Beine
 heller rötlichgelb. Kopf beim Männchen fast breiter beim Weibchen
 schmaler als der Halbschild, beim Männchen nach hinten erweitert,
 mit langen Schläfen, beim Weibchen mit kurzen, nach rückwärts
 vorragenden Schläfen, der Stirndruck beim Männchen stark, beim
 Weibchen schwach glänzend. Die Fühler gegen die Spitze stark ver-
 dickt, die vorletzten Glieder stark quer, das letzte Glied beim Män-
 nchen stark verdickt. Halbschild fast so breit wie die Flügeldecken,
 um die Hälfte breiter als lang, nach rückwärts stark verengt, die
 drei Mittelfurchen kaum angedeutet, die sechste Endverke deut-
 lich. Die Flügeldecken matt chagriniert, bei gewisser Annäherung mit
 rötlichem Kupferschimmer, weniger als der Halbschild. Hinter-
 schenkel glänzend, nur undeutlich punktiert. Länge 1.5 bis 1.8 mm.
 Luzon Los Baños und Mount Maquing. Mindoro, San Teodoro.
planicollis sp. nov.

Vorderkörper mit sehr schwachem, aber immerhin wahrnehmbarem
 Fettschimmer. Halbschild mit deutlicher Mittelfurche, die Stacheln
 am Vorderrand der Beine beim Männchen gerade. Färbung etwas
 weniger dunkel, die Flügeldecken um der Basis hinabgehender Kopf
 beim Männchen nicht breiter als der Halbschild, nach hinten kaum
 erweitert, beim Weibchen beträchtlich schmaler als der Halbschild
 mit kurzen Schläfen. Fühler kaum verschieden. Stirndruck auch
 beim Weibchen deutlich glänzend und mit einem Lösschen ver-
 sehen. Halbschild fast noch kürzer, mit scharfen Haken vor

hosen unmerklich pubescent, die mittleren Mittelfurchen gut angedeutet. Hinterbein ohne Kupferfleck. Länge 1 bis 2 mm.
 LUTON, Los Baños, Marikina, San Teodoro. *novae sp. nov.*

- 70) Hinterhül stark glänzend, nicht sehr mit unregelmäßiger Längsgeradheit 31

Hinterhül nur wenig glänzend, ziemlich dicht längsgerad. Fühler schwarz, die Fühler und Taster 6, ähnlich der Hüne. Hinterhül beim Männchen Kopf so breit wie der Hinterhül, um ein Drittel breiter als lang, nach rückwärts hochkantig erweitert, der Eindruck im vorderen Teil sowie eine Mitte sowie aus dem erhabenen Teil besteht, stark glänzend, die Seiten neben den Augen stark chagriniert und hinter den Augen dicht unregelmäßig. Die Fühler sind unregelmäßig, bis zum Hinterhül des Hinterhüls reichend, die vorderen Glieder um die Hälfte breiter als lang, die Mittel um die Hälfte breiter als lang, nach rückwärts stark verengt, von dem vorderen Hinterhül tief eingeschnitten, in der Mitte sind drei starke Furchen, welche mit einem tiefen Eindruck, der tief längsgerad ist, ist nur die kleine Kante zwischen den Furchen geglättet. Flügeldecken länger als der Hinterhül, stark quer, sehr dicht und kräftig längsgerad. St wie der Hinterhül wenig glänzend, Hinterhül stark glänzend, kaum punktiert. Länge 21 bis 22 mm. MEXICO, San Teodoro, Tuzigao. *novae sp. nov.*

- 71) Hinterhül an den Seiten weitläufig längsgeradheit und mit einem unregelmäßigen Eindruck. Hinterhül mit einem breiten, glänzend der Hinterhül ist breiter als der Kopf, der breiten Seiten, die Taster und die Hinterhül. Kopf so breit wie der Hinterhül, wenig breiter als lang, hinter den Augen gerade, unregelmäßig, vortritt an den Seiten mit chagrinierter Länge des breiten Mittels und der Stirnrande geglättet. Fühler kurz, die vorderen Glieder fast doppelt so breit wie lang. Hinterhül fast so breit wie die Flügeldecken, stark quer, nach rückwärts stark verengt, mit geraden Seiten und stumpfen bis zum Hinterhül mit tiefer Mittelfurche in der Mitte mit zwei kleinen Furchen, welche tief und wenig dicht unregelmäßig. Flügeldecken länger als der Hinterhül, wenig dicht, längsgeradheit glänzend. Hinterhül kaum punktiert. Länge 13 mm. MEXICO, San Teodoro, ein einziges Männchen.

novae sp. nov.
 Hinterhül an den Seiten ohne Streichung. Hinterhül ist glänzend bis punktiert, glänzend die Fühler, die Taster und die Hinterhül. Kopf beim Männchen nicht oder kaum schmal als der Hinterhül, mit parallelen, den Augendurchmesser an Länge überragenden Furchen, beim Weibchen wie schmal als der Hinterhül, nach rückwärts erweitert mit kurzen Seiten glänzend, fast nur mit einzelnen Punkten, beim Männchen hinter den Augen unregelmäßig chagriniert und zwischen den Augen unregelmäßig schwer sichtbar längsgeradheit. Stirn beim Männchen weit wie bei den vorherigen Arten mit zwei langen, geraden Streifen an den Seiten, sondern mit zwei schmalen dicht aneinander liegenden Zinken in der Mitte des Vorderhüls. Hinterhül wie bei der vorigen Art. Hinterhül beim Männchen stark beim Weibchen wenig quer, verengt längsgeradheit mit

stumpf verrundeten Hinterecken, Eins der Mitte mit einer in der Regel in der hinteren Hälfte verkürzten, bisweilen jedoch durchgehenden tiefen Längsfurche, sonst fast ohne jede Skulptur stark glänzend, ohne deutlichen Seiteneindruck. Flügeldecken etwas länger als der Halsschild, glänzend glatt, fast ohne jede Andeutung einer Punktierung. Vom *Oxytelus weiser* Faur., dem die Art sehr nahe steht, unterscheidet sie sich durch das Fehlen der seitlichen Mittelfurchen und der Seitengruben am Halsschild und den Mangel der Flügeldeckenpunktierung. Länge 2 bis 2.5 mm. LUZON, Los Baños und Mount Banahao. MINDANAO, Momungan und Port Banga.

dentatus sp. nov.

NEW LONGICORN BEETLES FROM FORMOSA, III
(COLEOPTERA: CERAMBYCIDÆ)

By J. LINSLEY GRESSITT

Of the University of California, Berkeley

ONE PLATE

The following descriptions are based on material collected by the author during two trips to Formosa, in 1932 and 1934, respectively. Two of the forms herein described are interesting as being subspecifically related to more northern forms, from north-central China and the northern Loochoo Island, respectively. Several of the other new species represent various new genera, some of which are apparently without very close affinities, and others have tropical Oriental relationships. The types are deposited in the United States National Museum, Washington, D. C., and in the California Academy of Sciences, San Francisco, those in the latter being unnumbered unique types on loan deposit. Types previously designated by the writer as "in the author's collection" are similarly deposited in the collection of the California Academy of Sciences. The author is indebted to Dr. E. C. Van Dyke and Mr. E. P. Van Duzee for use of material in the California Academy of Sciences.

CERAMBYCINI

Cerambyx minutum Gressitt¹ is a synonym of *Dymasius kisanus* Matsushita,² having been published one day later than the latter name. The type locality of *C. minutum*, "Kamikochi, Japan," is erroneous, and should have been Kisan, Formosa, the same as for *D. kisanus*. The author's specimen was received in 1932 from Y. Yano, the collector of Matsushita's material, but it was in an envelope with lepturids from Kamikochi. The carelessness of the above collector is further evidenced by the writer having seen lepturids from Kamikochi in collections sent to this country labeled as from Kisan, Formosa.

¹ Philip. Journ. Sci. 56, 379, published March 8, 1935.

² Trans. Nat. Hist. Soc. Formosa 26, 540, published March 7, 1933.

CALLICHTROMINI

Genus *AROMIA* Scrville, 1833

AROMIA FALDERMANNI subsp. *INSULARIS* Gressitt subsp. nov. Plate I, fig. 1

Large handsome, body largely iridescent green or violet, head violet-black greenish on frons and occiput, mandibles blue at apex, antennae dull blackish apically, scape shiny lavender blue, or green, the following three segments iridescent purplish blue, prothorax purplish blue with a large orange area on each side reaching from apex to near base and to two pairs of tubercles on each side of middle of disc, greenish and coppery below, the process bluish black; scutellum deep blue or green, elytra variable, greenish basally, remainder greenish purplish brown, legs purplish blue or greenish, tarsi testaceous, ventral surface dark greenish with purplish tinges.

Head broad, antennal supports high and close, frons small, gear large, surface minutely punctulate, irregularly clothed with dark hairs. Antennae slightly longer than body in male three-fourths as long in female, third segment longest, fourth to tenth decreasing slightly, acute externally at apices. Prothorax broad, with a thick tubercle at each side, and six on disc. One behind middle of anterior margin, a pair near center and three posteriorly, outer posterior ones highest, subtransverse, surface with erect dark hairs, particularly on the purple area. Scutellum elongate-triangular, grooved. Elytra slightly narrowed, rounded apically, and microgranulose punctate. Hind tibiae compressed and sinuate; first segment of hind tarsus not quite as long as remaining united. Length, 34 to 46 millimeters, breadth, 9.5 to 12.5.

Holotype, male, No. 51421, United States National Museum, Hsiao, central Formosa, altitude 1,400 meters, June 16, 1934, allotype, female, Hsienzan, Formosa, altitude 1,500 meters, June 24, 1934, paratopotype, male, June 15, five paratypes, Hsiao, Formosa, altitude 600 meters, June, 1934, and one paratype, male, Hsienyama, northern Formosa, altitude 1,600 meters, July 16, 1934 (Y. Izumi) in the author's collection, one paratype, Hsiao, in the California Academy of Sciences.

Differs from *Aromia faldermanni* Saund. from northern China, as which the present form has already been recorded from Formosa, in being larger, in having the antennae entirely dark, instead of orange on the latter seven segments, and in

¹ Trans. Ent. Soc. London II 2 4 (1850) 111, pl. 4, fig. 7.

having the orange portion of the prothorax separated into two spots, with the central portion violet, instead of extending completely across the dorsal surface. In *insularis* the vertex is more deeply and narrowly grooved, the prothorax is more constricted before the lateral tubercles, the posterior tubercle of each side of the scutellum is more pronounced, and the scutellum is narrower and more deeply grooved. Specimens from northern Formosa (Hsinchu area) differ slightly in having the scape and anterior pairs of legs more greenish, than purple, and the elytra largely greenish, but the iridescent coloration in these forms is exceedingly variable.

Genus CHLORIDOLI M. Thomson 1864

CHLORIDOLI LIOCHROANUM subsp. TAIWANUM Gressitt subsp. nov. Plate I, fig. 2

Moderately small, elegant, bright green, antennae violet-blue, legs steel blue, pronotum bluish on disc, scutellum shiny, slightly bluish green, elytra frosted green, lighter on shoulders and along basal portion of suture, slightly darker on disc, margins black at apices, papulose, with apical segments of both pairs brown except at apex, ventral surface bright green, finely clothed with short silvery pile.

Head moderately punctured, occipital and behind eyes more finely and sparsely, on vertex, frons, and genae and finely and coarsely on mandibles, genal area transverse, and subocular areas sublongitudinally corrugated, frons and vertex narrowly midlongitudinally sulcate to between eyes. Antennae two and one third times as long as body, male one third longer than female, scape thick, subacutely ectoapical, grossly punctured, subobliquely grooved externally, fourth segment slightly shorter than third, last longest. Prothorax longer than broad at base, laterally armed slightly behind middle with a blunt tubercle with a short, acute tip, disc transversely striolate near apex and base, transversely or obliquely so at sides, and longitudinally in middle, with the outer longitudinal striae diverging and incomplete, meeting the lateral ones in a blunt punctured area on each side of center, underside transversely corrugated anteriorly, subvermiculose punctate posteriorly, area around lateral tubercles smooth. Scutellum triangular, subacute behind, longitudinally grooved, nearly impunctate. Elytra narrowed posteriorly, apices narrowed and obtusely angulate near suture, surface granulose, except along suture near scutellum where it is finely, transversely corrugated and shiny. Legs all ventral surface finely punctured. Length, 14.5 to 18 millimeters, breadth, 3 to 4

Holotype, male, No. 51425, United States National Museum, Bagai, Formosa, altitude 1,400 meters, June 12, 1934, allotype, female, and six paratopotypes in the author's collection, one paratopotype in the California Academy of Sciences, all taken by the author, June 12 and 14.

Differs from *C. loochuana* Gressitt,¹ from Amami Oshima Island, in being smaller, in having the elytra green instead of bluish, only the central part of the disc of prothorax blue, the labrum green instead of black, the vertex lacking ridges and striae parallel to the median groove, the scutellum narrower and longitudinally grooved, the elytra more strongly narrowed and more acute apically, and the abdomen smoother.

MOLORCHINI

Genus *KURARUA* Gressitt novum

Narrow, elytra narrowed and slightly outwardly curved posteriorly, slightly abbreviated; antennae with third segment minute, posterior seven segments long and thickened, eyes finely faceted and emarginate; anterior coxae subconical, their cavities subacute externally, and apparently open behind, middle coxa cavities very narrowly open externally.

Head longer than broad, slightly broader than prothorax, neck narrowest immediately behind the eyes, eyes minutely faceted, prominent, very narrowly constricted behind the antennal insertions, the antennal supports broad, rounded, the vertex narrowly sulcate to middle of frons, with a row of punctures on each side, frons short and broad, an impunctate area at middle of apical margin and a pit at each side near clypeus, clypeus very broad basally, basal margin rather concave, apical margin slightly so; labrum transverse, very short, mandibles moderate, apices acute, sides densely punctate, palpi short, the last segment subelliptical; genae short. Antennae (male?) one-third longer than body, moderately thick, except for second to fourth segments: scape three times as long as broad, arched, second segment minute, longer than broad, thickened apically, third segment minute, no thicker than, and but twice as long as second; fourth segment half again as long as third, subequal to scape; fifth segment large, as long as two preceding combined, apex broadened, external angle subacute, following segments similar and progressively slightly longer, apical segment longest, with the apical fifth narrowed, first four segments

¹ Pan-Pacific Entomol. 9: 163.

Holotype, male, No. 51425, United States National Museum, Bukai, Formosa, altitude 1,400 meters, June 12, 1934, allotype, female, and six paratopotypes in the author's collection, one paratopotype in the California Academy of Sciences, all taken by the author June 12 and 14.

Differs from *C. cochoyomum* Gressitt⁴ from Amam Oshina Island in being smaller, in having the elytra green instead of olivaceous, only the central part of the disc of prothorax blue, the labrum green instead of black, the vertex lacking ridges and striae parallel to the median groove, the scutellum narrower and longitudinally grooved, the elytra more strongly narrowed and more acute apically, and the abdomen smoother.

MOLOPCHINI

Genus KIRARI A. Gressitt novum

Narrow, elytra narrowed and slightly outwardly curved posteriorly, slightly abbreviated, antennae with third segment minute, posterior seven segments long and thickened, eyes finely faceted and emarginate, anterior coxae subcircular, their cavities subacute externally, and apparently open behind, middle coxa cavities very narrowly open externally.

Head longer than broad, slightly broader than prothorax, neck narrowest immediately behind the eyes, eyes minutely faceted, prominent, very narrowly constricted behind the antennal insertions, the antennae supports broad rounded, the vertex narrow, medially sulcate to middle of frons with a row of punctures on each side, frons short and broad, an impunctate area at middle of apical margin and a pit at each side near clypeus, clypeus very broad basally, basal margin rather concave, apical margin slightly so, labrum transverse, very short, mandibles moderate, apices acute, sides densely punctate, palpi short, the last segment subapical, genae short. Antennae (male?) one-third longer than body, moderately thick, except for second to fourth segments, scape three times as long as broad, arched, second segment minute, longer than broad, thickened apically, third segment minute, no thicker than, and but twice as long as, second, fourth segment half again as long as third, subequal to scape, fifth segment large, as long as two preceding combined, apex broadened, external angle subacute, following segments similar and progressively slightly longer, apical segment longest, with the apical fifth narrowed, first four segments

⁴ Pan-Pacific Entomologist 163.

slightly shiny and punctate, following segments dull covered with minute, recumbent, bristlelike hairs. Prothorax subcylindrical two-fifths again as long as broad narrower than elytra, base as broad as middle, apex slightly narrower, disk fairly even, moderately sparsely punctate. Scutellum minute and narrow, apical portion concave. Elytra narrow, broadest basally, constricted anteromedially, slightly narrowed posteriorly, not quite reaching apex of abdomen, apices narrowed externally and rounded, surface with fairly dense shallow punctures. Anterior coxal cavities slightly rounded, broader than long, subacute externally, apparently open behind, moderately separated, the intercoxal process expanded and rounded posteriorly, middle coxal cavities extremely narrowly open to coxotrochantum, intercoxal process of mesosternum broad, reaching, but beyond middle acetabula, its apex concave, receiving process of metasternum, metasternum swollen and fairly densely punctured; mesosternum large, swollen posteriorly. Abdomen with first segment nearly as long as following two combined, second to last segments subequal, the fourth shortest. Legs five, femora pedunculate and apically clavate, hind tibiae slightly arched first tarsal segments slightly shorter than following two segments combined in anterior pair, subequal in second pair, and only slightly longer in hind pair.

Genotype.—*Kurania constrictipennis* Gressitt sp. nov.

Range.—Formosa (southern tip).

The genus is doubtfully placed in the Molorchini because the anterior coxal cavities are seemingly opened behind and the middle coxal cavities are very narrowly open anteriorly. It differs from most of the genera in the tube in the very short third and fourth antennal segments, the smooth prothorax and long elytra. It differs from *Anabris* in its much narrower form, longer and different antennae and prothorax, and more suddenly, and more briefly, clavate hind femora.

KURANIA CONSTRICTIPENNIS Gressitt sp. nov. (Plate I, fig. 12.)

Black, prothorax (except anterior margin) and forelegs red; elytra reddish brown basally and graysish brown on apical two-thirds. Body clothed with reddish brown hairs above and whitish hairs below.

Moderately small, narrow, prothorax long and plain, elytra constricted anteromedially, narrower and divergent posteriorly, not quite reaching apex of abdomen; antennae slightly longer than body third segment minute, only twice as long as second, and two-thirds as long as fourth, the latter equal to scape, fol-

lower segments long and thick, slightly flattened; legs fine, femora pedunculate and clavate, hind pair barely so for apical third. Length, 9.2 millimeters; breadth, 1.8.

Holotype, male (?), California Academy of Sciences; Kurara, Koshun, near South Cape, Formosa, altitude 140 meters, April 10, 1932, taken by the author.

This species superficially resembles *Cloamenuda satigara* Schw in appearance, because of its narrow form, red thorax, and clavate femora, but is easily distinguished by its peculiar antennae, more cylindrical prothorax, and narrowed clytra.

Genus *MERIONEDA* Pascoe, 1835

Matsushita¹ has synonymized *Merioneda uraiensis* Kano² with *M. formosana* Heller³ and Mitono⁴ has followed him. These species, however, are quite distinct. The two may be distinguished as follows:

Eighth and ninth antennal segments one-fourth as broad as long; middle femora clavate for less than apical half; hind femora clavate for only apical third, the club narrower than head, tibial spines not red.

M. uraiensis Kano (fig. 6)
Eighth and ninth antennal segments half as broad as long; middle femora clavate for their apical half; hind femora clavate for nearly their apical half, the club as broad as the head, tibial spine subperpendicular.

M. formosana Heller (fig. 2)

CLYPTINI

Genus *XYLOTRECHUS* Chevrolat, 1860

XYLOTRECHUS RUFONOTATUS Gressitt sp. nov. Plate I, fig. 5

Moderately small, narrow, attenuated posteriorly, body black except for an orange-red pronotal spot centered slightly before middle of disc, surface densely clothed above with green pile, paler on scutellum, and below with greenish gray, paler at the sides, antennae basally with sparse, fine, greenish hairs, apically with microscopic recumbent hairs; legs sparsely clothed with short, and some longer erect, pale hairs.

Head abbreviated below, surface granulate punctate with some large punctures below eyes, vertex and frons with a pair of approximate carinae, converging at each end, on middle of vertex, and lower part of frons; frons narrow, subparallel, very slightly narrowed in middle, lateral carinae obscure; eyes

¹ Journ. Fac. Agr. Hokkaido Imp. Univ. 24: 2 (1932) 239.

² Ins. Matsumurana 5 (1933) 43, fig. 1.

³ Ent. Blatt. 20: 1 (1924) 32.

⁴ Musho 8: 1 (1935) 32.

inverted comma-shaped, palpi fine, apical segments twice as long as broad, rounded-truncate, not broadened, apically. Antennae (female) short, fine, thickened apically, scape over twice as long as second segment and slightly longer than third, fourth and fifth subequal, each slightly shorter than third; following decreasing, tenth hardly longer than its diameter. Prothorax longer than broad, subcylindrical, only slightly swollen at sides, apex nearly as broad as base; disc somewhat raised posteriorly, surface densely and fairly heavily punctured, some very large shallow punctures at sides. Scutellum rounded, less than twice as broad as long. Elytra slightly broader than prothorax, not quite twice as long as head and prothorax united, gradually narrowed posteriorly, apices subtransversely truncate, a very short tooth at sutural angle; surface densely and finely punctured. Metepisternum very narrow, apparently broader posteriorly. Legs with femora only slightly swollen, middle femora most heavily punctured; hind femora slightly exceeding elytral apices; first segment of hind tarsus two and one-half times as long as following two united. Length, 11 mm. meters; breadth, 2.8.

Holotype, female, a unique, California Academy of Sciences, Hassenzan, Formosa, altitude 1,800 meters, June 21, 1932, taken by the author.

Differs from *X. cinerascens* Matsushita in its smaller size, more parallel and less prominently carinate frons, the two sides of the narrowly elliptic carinae very close, the prothorax more cylindrical, the scutellum narrower, and the first segment of hind tarsus relatively shorter.

Genus *PERISSUS* Chevrolat, 1863

PERISSUS CRISEUS Gressitt sp. nov. Plate 1, fig. 3.

Small abbreviated, subparallel; body black, fairly well clothed with pale greenish gray pubescence, whitish on sides of hind margin of prothorax and undersurface of body, where it is denser on sides of meso- and metathorax, body also with many erect pale hairs, except on tarsi and posterior three-fourths of elytra. Antennae with some moderate hairs on scape and a few projecting ones on inner side of following four segments, the sides very fine pubescence covering their entire surface.

Head wider than high in front; finely punctured, with some large punctures on occiput and genae; antennal insertions moderately distant, hardly raised, vertex plain; eyes inverted comma-shaped, deeply constricted; frons nearly as broad as long,

clypeus glabrous apically, apical palpal segments subtransversely truncate. Antennae (female) hardly over half body length, somewhat thickened apically, scape as long as second and third segments combined, fourth shorter than third, equal to following; latter few, slightly shorter. Prothorax subcylindrical no longer than broad, slightly broader at apex than base, slightly swollen at sides; granulose-punctate above. Scutellum short broad, and rounded. Elytra twice as long as head and prothorax united, broader than prothorax, slightly narrowed posteriorly separately narrowed and subobliquely truncate at apices, surface minutely granulose-punctate. Legs fine; hind femora and tibiae sinuate, the femora reaching just beyond elytral apices, first segment of hind tarsus barely twice as long as following two segments united. Length, 8 millimeters; breadth, 21.

Holotype, female, a unique, California Academy of Sciences, Taichuan, Formosa, altitude 1,600 meters, May 10, 1932, taken by the author.

Differs from *P. kankauensis* Schwarzer and the other species of the genus in lacking spots or fasciae. The head is very short in front, the prothorax short and the scutellum broad.

Genus *RAPHUMA* Pascoe, 1858

RAPHUMA NOTABLOIDES Green in sp. nov. Plate I, fig. 2.

Large, cylindrical, subparallel; body black, densely clothed with green or gray pubescence, paler beneath and nearly white at sides, marked with black as follows: A transverse suboval black spot on each side of middle of disc of prothorax, elytra with the external margins narrowly so for most of their length each with a straight longitudinal stripe from humerus to end of first third, a line curving out from behind scutellum, extending posteriorly, then transversely outward, joining end of humeral stripe, next a fairly large irregular median spot, touching margin but not suture, and finally a large, free, subcircular spot, one-fourth from apex. antennae clothed with fine, adpressed, greenish gray hairs; some suberect brownish hairs on underside of third and fourth segments; legs with the fine hairs goldish on tarsi, some brownish spinelike hairs on undersides of femora and tibiae.

Head strongly punctured on either side of occiput and below eyes, eyes large, distant, frons slightly longer than broad, narrowed basally. Antennae five-sixths as long as body in male, four-fifths in female; third segment longer than scape, fifth to seventh subequal, each longer than fourth and shorter than

th rd, remaining shorter; seventh to tenth broadened externally at apices. Prothorax broadest behind middle, narrowed apically, surface finely granulose. Scutellum rounded behind. Elytra slightly broader than prothorax, less than twice as long as anterior part of body; apices subobliquely truncate, dentate at both angles. Legs fairly fine, hind tarsi with first segment twice as long as following two united. Length, 17 to 20 millimeters; breadth, 4 to 4.5.

Holotype, male, No. 51426, United States National Museum, Sakabon, eastern Formosa (southwest of Karenko), altitude 1,350 meters, July 13, 1934, two paratopotypes and a female doubtfully referred to this species, Hassenzan, Formosa, altitude 1,400 meters, June 23, 1934, in the author's collection; all taken by the author.

This species is very similar in size and markings to *Chlorophorus notabilis* Pascoe, and quite probably represents the form recorded from Formosa as that species. It differs from the latter in having the antennae much finer, with the third segment longer than the first, the pronotum smoother, and the legs much finer, with the first tarsal segment much longer. Differs from *Raphuma virens* Matsushita in its much larger size, more sulphurous coloration, more swollen prothoracic disc, and relatively longer third antennal segment and first hind tarsal segment. One of the paratopotypes is gray instead of yellowish green, with the markings less distinct. The specimen from Hassenzan is entirely gray.

Genus DEMONAX Thomson, 1860

DEMONAX MATSUSHITAI Gressitt sp. nov. Plate I, fig. 13.

Small, narrow, parallel; black, clothed with gray pubescence, elytra with three pairs of dull black fasciae, the first consisting of a narrow oblique line from suture just behind scutellum to middle of disc, one-fifth from base, and a curved humeral line which nearly meets the former at its apex, second a moderately broad suboblique band slightly before middle, reaching from suture to margin, narrower anteriorly near suture, third transverse, wide, one-fourth from the apex, slightly constricted at the suture, all the bands with a few intermixed gray hairs and their margins indefinite, scutellum and undersides of pro- and mesothorax whitish gray; some suberect pale hairs on legs and undersurfaces of basal antennal segments and apices of following segments.

Head small as deep as wide occiput with some large punctures at sides, eyes distant, deeply emarginate, vertex concave, antennal supports subacute, internall frons longer than broad, broader apically. Antennae nearly as long as body in male reaching to last quarter of elytra in female scape not swollen apically, twice as long as second segment, third nearly half again as long as scape and fourth fifth longer than fourth and following, third and fourth each with an apical spine one fourth as long as the following segment, and of the fourth the longer. Prothorax one-fourth longer than broad, and very briefly constricted at apex and base, sides moderately swollen, surface shallowly reticulate-punctate with a few deeper punctures posterolaterally. Scutellum narrowly rounded behind. Elytra slightly broader than prothorax, parallel, apices transversely subemarginate truncate, external angles minutely toothed. Legs fine, hind femora hardly swollen, hind tarsi shorter than tibiae, first segment nearly twice as long as remaining united. Length, 8.5 millimeters.

Holotype, female, No. 51427 United States National Museum, Hassenzan, Formosa, at tide 1800 meters, June 24, 1934, and paratopotype male, the author's collection, taken the same day.

Differs from *Isoscelus Matsushitani* in its slightly larger size, more briefly joined third and fourth antennal segments, and narrower elytral bands, the first extending obliquely from behind scutellum beside another on humerus. Named in honor of Mr. Masaki Matsushita, of Toyohara.

Genus *CHLOROPHORUS* Chevrolat, 1863

CHLOROPHORUS LEONACRIDES Gressitt, sp. nov. Plate I, fig. 11

Laterally compressed, slightly narrowed behind, body black, orange at either side of scutellum, largely clothed with pubescence, head and antennae sparse, clothed with gray, prothorax largely clothed with grayish green, greenish yellow at each side of basal margin and greenish white beneath, scutellum densely clothed with pale yellow, elytra black, slightly yellowish on basal margin, crossed by fasciae of greenish yellow, the first extending obliquely from suture slightly behind scutellum to one-third from base, where it turns exteriorly and somewhat anteriorly, not reaching margin, the second transverse, two-thirds from base, broad at suture, narrowing laterally, not

reaching margin; its hind margin straight, the third an oblique apical spot bounded by a line from suture, halfway between second band and apex, to external apical angle, black portions with some adpressed bronzy hairs visible in certain lights, ventral surface grayish below and yellowish at sides, legs moderately clothed with recumbent, and a few erect, hairs, some erect pale hairs on head, underside and bases of prothorax, and elytra, antennae with some internal hairs fused to form false, subapical spines on most of the segments.

Head deep, hardly broader than apex of prothorax, heavily punctured, a few larger and shallower punctures on sides of occiput, antennal insertions distant, frons twice as high as wide, slightly broader apically, a low median carina extending most of its length, genae fairly long; apical palpal segments broadened and subobliquely truncate apically. Antennae (female) fine, just over half as long as body, scape small, three times as long as second segment, equal to third, fifth just longer than fourth, shorter than third; remaining shorter than fourth, successively diminishing in length. Prothorax one-fourth longer than broad, hardly narrower at apex than at base, only slightly swollen at sides, surface granulate. Scutellum broadly scutiform. Elytra not quite twice as long as head and prothorax united, slightly broader than prothorax, moderately narrowed posteriorly, transversely subsinuate-truncate apically, base swollen in middle; surface finely punctate. Ventral surface fairly densely and fine-punctured; visible portion of metepisternum hardly broader anteriorly than posteriorly. Legs fairly long, the hind femora extending one-fifth their length beyond elytral apices; middle femora very heavily punctured, hind tarsi with first segment nearly half again as long as remaining united. Length, 12 millimeters; breadth, 3.

Holotype, female, a unique, California Academy of Sciences; Saaha, by Lake Candikus, central Formosa, altitude 750 metres, May 31, 1934.

This species is not closely related to any other species of the genus known to me. It differs structurally from *C. signatellus* Chev. in having the head longer, the antennae finer, more distantly inserted, and with false subapical spines, the prothorax narrower, the scutellum smaller and the hind legs longer, it is very similar in markings to large specimens of *Perusius kawkaensis* Schwarzer. Possibly this species should be placed in

Diagnosis. because the antennal insertions are rather distant, but the spines on the inner sides of antennal segments are composed of groups of hairs instead of extensions of the segments, and furthermore, the third antennal segment is not longer than the scape.

(*CELOBOPHOBUS* *MFWAL* *Gen. nov.* Plate I, Fig. 12)

Cylindrical, parallel; black, largely clothed with dense green pubescence; head and antennae green, prothorax green, with a black spot on each side, and a wide, inverted Y-shaped black marking on disc; scutellum green; elytra green, marked with three sets of fasciae. The first a zerolike mark on basal portion, not touching suture barely touching base and with a short extension along external margin, the second a wide, transverse band at middle, nearly straight behind, and extending anteriorly some distance along suture, another anterior extension joining hind part of zerolike mark at side; the last a large squarish spot in last third, free from suture and apex but touching margin; ventral surface clothed with paler green, nearly white on the pleura; legs sparsely clothed with grayish green.

Head higher than wide; frons squarish; eyes inverted comma-shaped; antennal insertions fairly close, occiput heavily punctured on sides. Antennae (female) slightly more than half as long as body, scape slightly arched, barely longer than third segment, fourth slightly shorter than third; following gradually decreasing, most of the segments with a row of fine setae below. Prothorax subglobular, slightly longer than broad, narrower at apex than base. Scutellum slightly narrowed, rounded at apex. Elytra fairly long, slightly narrowed, apices obliquely truncate hardly toothed at either angle. Legs fairly fine, hind tibiae fairly prominently spined internally at apex; hind tarsi with first segment as long as remaining united. Length, 15 to 16.5 millimeters; breadth, 3.5.

Holotype, female, United States National Museum, Barasan, northern Formosa, altitude 1,750 meters, July 23, 1934; paratype, female, in the author's collection, Hori, Formosa, July, 1934; paratype, male, Tai Kwong, Lam Mo district, Hunan Province, China, July 26 to 28, 1934 (F. K. To), in the collection of the Lingnan Natural History Survey and Museum, Canton.

Very similar to *C. rarus*, of Europe, and *C. dubius* Matsushita, of Formosa, differing from both in having the elytra longer, the

pubescence green instead of yellowish gray or whitish gray. The discal marking of prothorax different and other characters

ETYMOLOGY:

Genus BUNOTHORAX Gressitt novum

Body strongly compressed dorsoventrally; antennae with basal segments tufted, prothorax 11-noded; elytra tricarinate; legs short.

Head abbreviated anteriorly, frons short; vertical vertex broad, concave, grooved medially; occiput smooth; impunctate, eyes deeply constricted; moderately finely faceted, cuneus approaching mandibles; genae minute; palpi short; apical segments compressed, truncate apically. Antennae (male) half again as long as body, first six segments heavily clothed with long black bristles on apical half; following segments with only a few hairs; scape strongly thickened, shorter than third segment; second longer than broad, third and fourth equal, each slightly shorter than fifth to tenth, which are subequal, last twice as long as third, fourth to ninth subangulate externally at apices. Prothorax nearly twice as broad as long; disc with nine more or less rounded tubercles, one at each side near anterior margin, a pair just before middle, one behind center and two at each side near hind margin; each side also with a strong, blunt tubercle; some large irregular punctures between or on sides of tubercles, surface furnished with long black bristles, as on head. Scutellum equilaterally triangular, subacute; concave basally; Elytra separately produced anteriorly at middle of base; narrow basally, hardly broader than prothorax, very slightly broadened posteriorly, rounded apically, disc with three strongly raised lines; another weaker one between outer two; surface densely and grossly punctate, reticulate, glabrous, a few short black hairs along posterior portions of outer margin. Pleuristernal process rounded, prominent; mesosternal process narrow, squarish in lateral outline slightly more prominent anteriorly, middle coxal cavities open externally. Legs short; first segment of hind tarsus less than twice length of second.

Genotype.—*Sternophiles tatei-ayocusa* Kano

Range.—Formosa.

This genus differs from *Sternophiles* Guér. in having a much flatter body, shorter, tuberculate prothorax, plumed antennae, more strongly carinate and punctate, and more glabrous, elytra, longer pro- and mesosternal tubercles, and shorter legs.

BLINOTOMAX TAKASAGIENSIS (Kano). Plate I, fig. 2.

Sternophanes takasagienis KANO, Kontyu (Tokyo) 8 (1922) 278.

Body black, elytra bright red, basal antennal segments with tufts of posteriorly directed black bristles, head and prothorax with erect black bristles, prothorax shiny, with eleven rounded tubercles, elytra nearly naked, strongly punctured and ribbed. Length, 13 to 18 millimeters.

Distribution.—Formosa, Arisan (type locality). Taiwan, a male in the author's collection, June, 1934.

NEBORINI

Genus *SALINIA* Pascoe, 1866

(1) *SALINIA BIRTH ORNIS* Greenh. sp. nov. Plate I, fig. 12.

Moderately narrowed, subparallel; antennae very hairy posteriorly. Body black, clothed with pubescence of mottled gray-brown, marked with brown, light gray, and ochraceous, head incompletely clothed with pale buff, mottled with darker in front and with a pair of longitudinal dark brown stripes on occiput, and another behind each upper eye lobe, antennae with scape gray, the following segments pale gray basally and black apically, apical segments largely black, long internal hairs similarly colored, longer and denser posteriorly; prothorax gray-brown, spotted anteriorly with ochraceous and with four indistinct dark stripes on disc; elytra whitish gray, dotted with black punctures, crossed by two irregular brown fasciae, one behind base, the other behind middle, and spotted irregular with ochraceous; undersurfaces densely clothed with gray and ochraceous, reddish on posterior margins of abdominal segments, also some flying gray hairs, legs brown and buff; tarsi with first, second, and last segments light gray basally, black apically, the third entirely black.

Head sparsely punctured; eyes small, the two lobes connected by a fine line, frons higher above than below. Antennae one-fourth longer than body, apical segments and apical portions of basal segments clothed internally with long hairs, scape with an incomplete cleatrix; third segment longer than scape and fourth, following rapidly decreasing in length. Prothorax broader than long, tuberculate anteriorly at sides, disc with five swellings, a pair of elongate ones in the middle and three in a transverse row near base. Scutellum small and narrow. Elytra broad, rounded behind, surface sparsely and heavily punctured. Sterna. processes with opposing faces vertical. Length, 13 to 14 millimeters breadth, 4.5 to 5.

Holotype, female (?) No. 51429, United States National Museum, Hsienzan, Formosa, altitude 1,300 meters, June 21, 1932, two paratopotypes in the author's collection, and a paratopotype in the California Academy of Sciences (Van Dyke collection), June 22 to 26, 1934.

This species differs from *S. alternans* Schwarzer with its hairy antennae the scape and apical segments shorter, its tuberculate prothoracic disc, and its vertical sternal processes.

HIPPOPHINE

Genus PSEUDOCALANUS Kratz, 1939

PSEUDOCALANUS LEPTISCHUS Gressitt sp. nov. Plate 1, fig. 14

Extremely narrow and elongate, antennae very fine and long head fully as deep as rest of body, brown, anterior femora and scape dull reddish brown, rest of antennae dark brown, head and thorax blackish brown, reddish brown on posterior margin of pronotum, clypeus dark amber, labrum light reddish brown, mandibles and palpi dark reddish brown, elytra dull chocolate-brown, redder at sides, legs and abdomen very dark chocolate-brown; antennae with basal five segments clothed below with fine erect hairs, rest of body very finely clothed with minute, pale grayish brown hairs, sparser on elytra and denser on midarea of pronotum, scutellum, and basal portion of elytral suture.

Head squarish in front, excluding mouth parts, broadest at eyes, slightly broader across genae than at antennal tubercles; vertex fairly deeply concave between antennal tubercles, which are prominent, and swollen internally; frons weakly convex, apical margin slightly concave, clypeus short, impunctate, labrum convex, punctulate, palpi with apical segments of each pair swollen basally and acutely attenuate apically. Antennae two and one-half times as long as body, exceedingly fine, scape cylindrical, reaching well beyond middle of prothorax, second segment barely longer than broad, third segment longer than first and shorter than fourth, fourth to tenth subequal, eleventh nearly double third. Prothorax roughly cylindrical, one-third longer than broad, widest before and behind middle. Scutellum longer than broad, rounded behind. Elytra long and narrow, slightly narrowed posteriorly, apices narrowed externally and produced into a blunt point at suture. Abdomen with first segment nearly twice as long as fourth, others subequal. Legs with femora swollen, hind pair no longer than first abdominal segment. Body largely finely punctured, elytra subseriate, abdomen most finely, and antennae and lateral portions of me a-

sternum most heavily. Length, 10.5 to 12 millimeters, breadth, 1.5 to 2.

Holotype, female No. 51128. United States National Museum. Arisan, central Formosa, altitude 2,300 meters, May 23, 1934, three paratopotypes, females, May 23 to 25, and a paratype, male. Tainchizan, northeastern Formosa, altitude 1,800 meters, May 8, 1932, in the author's collection, all collected by the author.

This species differs from *P. filiformis* Fairm. in being smaller and less parallel, in having the antennae finer and less hairy below, and the elytra acute apically and lacking longitudinal stripes.

Genus *METOPOPLECTUS* Gressitt novum

Frons trapeziform, head directed posteriorly below, antennae very long, scape swollen apically, prothorax nontuberculate anterior coxal cavities closed behind, middle coxal cavities open exteriorly, tarsal claws moderately divergent, form only moderately elongate, narrow in fore body, shoulders prominent, elytra slightly narrowed posteriorly.

Head as broad as prothorax, subacute at apex, nearly twice as broad at genae as at antennal tubercles, which latter are prominent and close, frons higher than wide, subparallel, eyes small, almost entire, hardly extending behind antennal supports, not very finely faceted, genae large, clypeus short, labrum with apical margin slightly concave, palpi with last segment of each pair narrowed and subacute apically. Antennae two and two-thirds to three and one-half times as long as body, scape reaching nearly to posterior margin of prothorax, gradually swollen posteriorly, second segment about as long as broad, third to tenth subequal and nearly as long as first, last longer than two preceding combined. Prothorax cylindrical, one-fourth longer than broad, base hardly broader than apex, two-thirds as broad as elytra. Scutellum as long as broad, rounded behind. Elytra very slightly narrowed in basal three-fourths, apices fairly abruptly narrowed and narrowly rounded or subtruncate, at suture. Abdomen with first segment not quite as long as following two united. Legs short, femora moderately swollen, mid part reaching to middle of abdomen, middle tibiae coarsely grooved exteriorly, tarsi nearly as long as tibiae, the hind pair with the first segment barely as long as the following two united, last longest.

Genotype.—*Metopoplectus taiwanensis* Gressitt sp. nov.

Range.—Formosa and eastern China.

This genus is established for the following new species, as well as for *Cleptomelopus orientalis* Matsuo and an undescribed species from China.

Differs from *Cleptomelopus* Thomson in being broader, in having the head shorter and less acute, the frons broader, the scape more swollen apically, the succeeding antennal segments lacking long apical hairs, the prothorax being less elongate and less narrowed apically, the elytra less attenuated, less heavily punctured basally, and not spread posteriorly, their surface with concave areas, and from *Pethenus* in having the superior lobes of eyes lacking, the antennae much less hairy, the scape swollen, the prothorax narrower and the elytra shorter. The form is less linear than in most *Hippopodamia*, the elytra being considerably broader than the head and prothorax.

HYPOPHLECTIS HAWAIIENSIS (Gerritt) n. sp. Plate I, figs. 11-14

Largely dull chocolate-brown, elytra partly very light brown, body clothed below with short grayish brown hairs and above with dark chocolate, and light tawny brown, hairs, front of head slightly reddish brown with a few pale hairs, thicker at sides, occiput blackish brown with a narrow mid longitudinal stripe of tawny hairs, and similar clothing behind eyes. Antennae with scape reddish brown on base, two-thirds, the apex blackish, remaining segments light brown basally, and dark chocolate-brown apically. Prothorax with a median, and two lateral, broad, longitudinal, tawny stripes. Scutellum tawny, elytra dark brown basally, a few oblique pale stripes extending from basal portion of disc, humerus and internal margin, converging and meeting suture before middle, then an oblique dark brown area, irregular posteriorly and broader at suture, along which it extends posteriorly, joining near one of two longitudinal subapical dark stripes, inner one not adjacent to suture, extreme apex dark, intervening postmedial and subapical areas pale brown.

Head fairly densely and finely punctured, not quite as broad near apices of genae as at eyes, much narrower across antennal tubercles, eyes small, convex, very slightly longer than broad, rounded below and bluntly angulate above. Antennae three to three and one-half times as long as body, scape swollen apically, very slightly longer than third segment, third to tenth subequal, and very long. Five basal segments sparsely clothed below with short fine hairs. Prothorax barely longer than broad, very slightly swollen in middle, base two-thirds as broad as elytra, surface fairly densely and finely punctured. Elytra very slightly narrowed in base, three-fourths, apices narrowly rounded at

suture; surface fairly densely, and moderately heavily, punctured in twelve or more rows, less heavily so posteriorly. Ventral surface moderately punctured, more heavily on sides of metasternum and more finely on abdomen. Length, 9.5 to 10.3 millimeters; breadth, 2.2 to 2.5.

Holotype, female, No. 81430, United States National Museum. Sakahen, northeastern Formosa, altitude 1,100 meters, July 16, 1934, allotype, male, Hori, central Formosa, at about 600 meters, June 9, 1934, in the author's collection, both taken by the author.

Differs from *M. orientalis* (Mitsuo) in its smaller size, its more swollen, and more arched, antennal scape, its less cylindrical prothorax, its rounded, instead of subacute, elytral apices, and its strongly punctured metasternum. The elytra are also less densely punctured than in the latter.

Genus *ANISANIA* Grensitt novum

Elongate, parallel-sided, cylindrical; frons narrow, broadest at antennal tubercles, which are very prominent, antennae twice as long as body; pronotum with a small tubercle at each side; anterior coxae subglobular, separate, closed behind; middle coxal cavities open exteriorly; middle tibiae grooved externally; legs short. hind femora nearly as long as first two abdominal segments, tarsal claws divaricate; elytra long, rounded-truncate apically.

Head as broad as prothorax, higher than wide, directed slightly posteriorly below; eyes moderately narrow and long, very narrowly constricted behind antennal supports, ventral lobe large, fairly closely approaching mandibles, dorsal lobe minute, antennal tubercles large and very prominent, contiguous basally, diverging at an angle of 100° , frons higher than wide, broadest at antennal supports, subparallel below, swollen, clypeus short; labrum longer than clypeus, more than half as long as broad, punctulate, mandibles short, very thick basally, genae minute, palpi with the apical segment of each pair subulnariform, thickened basally and truncate apically. Antennae two and one-half times as long as body in male, twice as long in female, scape reaching to about middle of prothorax, subcylindrical, narrow at base, thickest before apex, external apical margin slightly emarginate, second segment broader than long, third to seventh segments subequal, cylindrical, progressively slightly longer and finer, last four segments shorter and finer, last longer than tenth, shorter than third. Prothorax as long as broad, broader at apex than at base, slightly constricted before the base, furnished with a

short, conical tubercle at each side slightly behind middle a slight swelling behind middle of disc, middle of posterior margin raised. Scutellum nearly as long as broad, rounded truncate behind. Elytra long, parallel slightly constricted before middle, very slightly narrowed and subobliquely truncated at apices, surface subseriate-punctate. Anterior coxae prominent, subglobose, their cavities angulate externally, separate, closed behind, middle coxae less prominent, their cavities open externally to epimera, metasternum swollen at sides and abruptly decurved apically, metoposternum narrowed posteriorly. Abdomen with last segment as long as first, second, third, and fourth successively shorter, last segment slightly emarginate below at apex in male concave in apical half in female. Legs short, femora moderately swollen, tarsi as long as tibiae, first segment of hind pair not as long as following two segments combined, claws divaricate.

Genotype—*Arisanus submarmorata* Gressitt sp. nov.

Range. Formosa (central).

This genus is doubtfully placed in the Hippopsini, differing from the characteristic genera in having the frons narrower apically, the antennae not emarginate below, except for scape, the prothorax with a small tubercle at each side, and the tarsal claws divaricate. Differs in form from *Pseudocalamobius* in being broader and more cylindrical, with the antennae thicker, and shorter in the male.

ARISANIA SUBMARMORATA Gressitt sp. nov. Plate II, fig. 16

Elongate, parallel, elytra two and one-half times as long as head and prothorax united, frons narrowed apically, antennal tubercles prominent, prothorax slightly tuberculate laterally, hind femora hardly reaching to end of second abdominal segment.

Reddish brown, blackish in front of head, middle of prothorax and ventral surface of body, body largely covered with short, recumbent brown hairs, forming mottled patterns, antennae poorly clothed, scape only with very short fine erect hairs below, head, prothorax and scutellum with light rusty brown hairs, and irregular raked patch in middle of disc of latter, elytra with a small, irregular subbasal discal spot and the apical third largely light rusty brown, a short transverse hairless band preceding the latter area, anterior three-fifths thin and irregularly clothed with small spots of grayish brown hair, ventral surface grayish brown, sides of metathorax apical segments, and sides

of basal segments, of abdomen irregularly rusty. Length 7.5 to 10.5 millimeters, breadth, 1.5 to 2.5.

Holotype, male. No. 51431, United States National Museum, Arisan, Formosa, altitude 2,250 meters, June 1, 1932. allotype female and 3 male paratopotypes in the author's collection, all taken the same day by the author.

The middle portion of each antenna segment is pale in the female.

Genus *OBEREA* Mulsant, 1839

OBEREA BREVITHORAX Greenitt sp. nov. Plate I fig. 17

Elongate, prothorax short, elytra long, narrowed after basal third and slightly expanded preapically, head and antennae pitch black, except for amber-colored clypeus and pale orange palpi; prothorax pale orange below, darker orange above with a very small black spot at each side near base, scutellum brownish black, elytra grayish black along suture and shiny black on shoulders, sides, and apices, yellow on middle of basal margin and with a walnut brown stripe along middle of disc to near apex, dotted with black punctures, subhumeral areas orange, ventral surface orange, except for black metepisternum, posterior three-fourths of metasternum, lateral margin of first, sides of second and third, and all but base of fifth abdominal segments, ninth tibiae, external margins of anterior and middle tibiae and tarsi above except for base of third segment and large part of last which is brown. Forebody and underside clothed with short, recumbent hairs and longer and sparser erect pale or golden hairs, those on last abdominal segment and the erect ones on head black, elytra with pale recumbent hairs on inner black portion and some erect ones on basal portion, the brown stripe nearly naked, shiny.

Head strongly swollen in front, very slightly concave on vertex, fairly heavily punctured except on posterior portion of occiput, eyes large, deeply constricted, ventral lobe broader than long, closely approaching mandibles. Antennae (female) reaching to last fifth of elytra, all segments except second subequal in length. Prothorax very short, two-thirds as long as broad, hardly as broad as elytra at base, swollen above and with a raised area at each side, surface irregularly punctured, more sparse on center of disc. Scutellum short, its posterior margin transverse. Elytra fully four times as long as head and prothorax united, narrowed and subparallel after first quarter, slightly expanded in last fifth, apices obliquely emarginate laterally with a small tooth at suture and a larger one at exter-

anal angle surface with six longitudinal rows of large punctures. Mesepisternum moderately punctured, narrowed and raised above, metepisternum acutely punctured, metasternum punctured moderately at sides, more finely anteriorly, abdominal segments slightly punctured at sides. Legs short, hind femora reaching but slightly beyond end of first abdominal segment. Length, 19 millimeters, breadth 25.

Holotype, female California Academy of Sciences, Hori Formosa, altitude 500 meters. June 9, 1934, collected by the author.

This species differs from *O. bi-denticulata* Picot in having the prothorax short, the elytra much more attenuate, more oblique at the apices, more heavily punctured, relatively naked and partly brown, and the last abdominal segment shiny black except at base. It differs from *O. holozantha formosana* Picot in having the head broader, the prothorax much shorter and the elytra more attenuate, besides being largely black and brown.

JAPANESE NAMES

1. *Aromia faldermanni ussuriensis* subsp. nov. K kubi-josobane-kamikiri.
2. *Chloridolum locheoum asiaticum* subsp. nov. Ta wan-moder-kamikiri.
3. *Kuraria consocii penins* gen. et sp. nov. Kuraru-hosobane-kamikiri.
4. *Merionida iraensis* Kano. Ira-momobuto-hana-kamikiri.
5. *Merionida formosana* Heller. Momobuto-hana-kamikiri.
6. *Xylotrechus ruficollatus* sp. nov. Akamon-tora-kamikiri.
7. *Perissus griseus* sp. nov. Usuao-tora-kamikiri.
8. *Raphuma notabundus* sp. nov. Soraken-tora-kamikiri.
9. *Demonax matsuikita* sp. nov. Matsushita-tora-kamikiri.
10. *Chlorophorus demonacandes* sp. nov. Saisha-tora-kamikiri.
11. *Chlorophorus muonai* sp. nov. Mwa-tora-kamikiri.
12. *Bunathorus* gen. nov. takasagoensis (Kano). Takasago-beni-kamikiri.
13. (?) *Saxinis hirticornis* sp. nov. Kehgo-gomafu-kamikiri.
14. *Pseudocalamobius cepissimus* sp. nov. Kōzan-dōboso-kamikiri.
15. *Metoponectus taiwanensis* gen. et sp. nov. Hime-chicksi-genaga-kamikiri.
16. *Arisema subnervosa* gen. et sp. nov. Arisan-higenaga-kamikiri.
17. *Oberca brevitarsis* sp. nov. Tankai-riingo-kamikiri.

ERRATUM

In the preceding paper of this series, Phil. Journ. Sci. 68 (1935) 253-266 or pages 259, 260, and 266, the genus should read *Anoplotheromophya*, instead of *Anoplodermophya*.

ILLUSTRATION

PLATE 1

[Magnified 15 times.]

110. 1 *Aromia feldermanni* subsp. *insularis* Gressitt nov., holotype.
- 2 *Chloridolum toschonanni* subsp. *taivanense* Gressitt nov. holotype.
- 3 *Eumethorus* (gen. nov.) *takusagoumii* (Kano) Taiwan Formosa.
- 4 *Raphanus notabitis* Gressitt sp. nov. holotype.
- 5 *Kivarna constrictipennis* Gressitt gen. et sp. nov., holotype.
- 6 *Merionada uruensis* Kano, Dulau Formosa.
- 7 *Merionada formosana* Heller, Hsiaoan, Formosa.
- 8 *Perissus grisea* Gressitt sp. nov. holotype.
- 9 *Xylotrechus rufanotulus* Gressitt sp. nov., holotype.
- 10 *Demonax matensis* Gressitt sp. nov., holotype.
- 11 *Chlorophorus demanacoides* Gressitt sp. nov. holotype.
- 12 *Chlorophorus niger* Gressitt sp. nov., paratype. Ilum Formosa.
- 13 (?) *Saiaia hirticornis* Gressitt sp. nov., holotype.
- 14 *Pseudocamelinus aptissimus* Gressitt sp. nov. holotype.
- 15 *Metopoplectus taiwanensis* Gressitt gen. et sp. nov., holotype.
- 16 *Arisaia subminimata* Gressitt gen. et sp. nov. holotype.
- 17 *Oberca brevithorax* Gressitt sp. nov., holotype.



NEW OR LITTLE-KNOWN TIPULIDÆ FROM EASTERN ASIA (DIPTERA XXXII)

By CHARLES P. ALEXANDER

Of Amherst, Massachusetts

TWO PLATES

Virtually all of the species of crane flies herein discussed are from Hainan Island where they were collected in 1935 by Mr. J. Leisley Gressitt. A few additional species are from the Khasi Hills Assam section of Mr. S. S. Barua's collection of Coleoptera. All the types of novelties described at this time are preserved in my very extensive collection of these flies. I wish to express my sincere thanks to the above mentioned entomologists for their friendly contribution in continuing this study of the Tipulidæ of southeastern Asia.

The rather extensive collections made in Hainan proved to be of exceptional interest since virtually nothing had been made known of this insect fauna area. I am indebted to Mr. Gressitt for the following notes concerning various collecting stations at which Tipulidæ were secured:

TAI HUAN. Altitude 2,000 feet by stream in the northernmost foot of the Five Finger Mountains, south of the middle of the island, 10 miles south of Fiu Heang.

TAI HAN. Altitude 2,500 feet, small valley between passes of the Lei Moter Ranges and the Red Mist (Hong Mo) Range, on way from Nodoo to the Five Finger Mountains, about 20 miles south of Tai Huan.

TAI HAI. Altitude about 900 feet, a small village near Vo Lou in Dam Cha, west and slightly south of Nodoo about 30 miles, flat country.

NOOHA (Nohai). Altitude about 1,000 feet, flat country in the north-west-central part of the island.

PAN TA. Altitude about 1,250 feet, 22 miles south of Nodoo, region of low mountains.

CHUNG KONG. Altitude about 1,600 feet, between Nodoo and Lei Moter mountains near Dergang River.

* Contribution from the entomological laboratory, Massachusetts State College.

DWA BI (TAI PIN) Altitude about 1,500 feet at foot of north end of Loi Mother Range, about 20 miles west and slightly north of Lianui, near the center of the island.

LIAMI Altitude about 1,200 feet, near the eastern edge of mountains on a low plateau, with mountains on its east between it and the great northern plain. From the hills around can be seen the Loi Mother Mountain, Red Mist Mountain, and the Five Fingers to the west and southwest.

Besides the score of species of Tipulidae described as new in the present report, Mr. Gressitt secured a number of additional crane flies that are recorded herewith to complete the data.

LIMONIA RHIPIDIA PULCHRA de Meijere

Ta Han, June 13, 1935.

LIMONIA GERANOMYIA ARCENTIFERA de Meijere

Ta Han, June 14, 1935, Ta Han, June 7, 1935, Lianui, July 31, 1935.

LIMONIA THRYPTICOMYIA APICALIS Wiedemann

Ta Han, June 11, 1935, Ta Han, June 22 and 23, 1935

CONOSIA PRORATA Wiedemann

Ta Han, June 15 to 18, 1935, Ta Han, June 22 to 24, 1935, Ta Han, July 3, 1935, Nodda, June 30, 1935, Chung Kon, July 17, 1935.

TRENTPOHLIA (MONGOMIA) PENNIPES (Osten Sacken)

Chung Kon, July 18, 1935

TRENTPOHLIA (TRENTPOHLIA) PICTIPENNIS Bequaert

Ta Han, June 11, 1935, Ta Han, June 21, 1935

TRENTPOHLIA (TRENTPOHLIA) TRENTPOHLII (Wiedemann)

Ta Han, June 11, 1935, Nodda, June 20, 1935, Lianui, July 2, 1935, Ta Han, July 4, 1935, Chung Kon, July 18, 1935, Dwa Bi, July 21, 1935

GONOMYIA (TIPOPHLEPS) BRUNOCLORATA Alexander

Ta Han, June 23, 1935. Known hitherto only from Luzon

GONOMYIA LIPOPHLEPS INCOMPLETA Brunetti

Ta Han, June 14, 1935, Ta Han, July 3, 1935, Chung Kon, July 18, 1935, Dwa Bi, July 20, 1935

TIPULINÆ

LONGURIO HAINANENSIS sp. nov. Plate I, fig. 1

General coloration of mesonotum and abdomen yellow and orange, head variegated with brownish black on lateral part

lons of posterior vertex. wings narrow tinged with gray. R_s short and arcuated, much shorter than R_{4+5} , much a short distance before fork of M_{3+4} .

Female. Length about 20 millimeters, wing, 16.

Fronal prolongation of head yellowish white, nusus conspicuous, black, palpi black. Antennæ dark brown throughout, very small, first backward scarcely extending beyond the posterior border of head. flagellar segments cylindrical, with only conspicuous verticils. Head whitish on front and anterior vertex, the central portion of posterior vertex and occiput yellow, the lateral portions of latter, together with the posterior orbit brownish black.

Pronotum and propleura black. Mesonotum almost uniform yellow, restrictedly variegated by darker including the lateral ends of suture, margins of parascutella and posterior border of medioergate. Pleura obscure yellow, the posterior border of dorsopleural membrane with a conspicuous velvety black area, posterior portion of pleurotergal tubercle a little darkened. Halteres dirty white, the knobs darkened. Legs with the coxæ yellowish testaceous, trochanters whitened, remainder of legs brownish black. Wings (Plate I, fig. 1) narrow and hyaline or with a faint grayish tinge, stigma and cell Sc_1 a little darker, veins brown. Macrotrichia on outer portions of veins R_2 and R_{4+5} , trichia on outer medial branches lacking or reduced to one or two scattered setæ. Venation. R_s short and arcuate, much shorter than R_{4+5} , distal end of Sc_1 atrophied, much a short distance before fork of M_{3+4} , cell 2d A relatively wide.

Abdominal tergites orange-yellow, the margins restrictedly paler, intermediate tergites with vague redal darkenings, on outer segments more evident and suffusing the caudal borders of the segments, sternites more yellowish, with a more or less distinct brown median stripe, pleural membrane infuscated. Ovipositor with small and inconspicuous, blunt valves.

Habitat.—China (Hainan Island).

Holotype, female, Dwa Br, altitude about 1,500 feet, Jan. 20, 1935 (*Gressitt*).

Longura hamatensis is readily told from the four species hitherto described from China and Japan by the narrow, subhyaline wings, with R_s unusually short and arcuate. The most similar of the above-mentioned forms is *L. juncus* Edwards (China, Formosa). I am not fully convinced that *Sphæronotus* de Meijere can be maintained as a genus distinct from *Longura* Loew.

NEPHROTOMA BAYANICA sp. nov. Plate I, Fig. 2

General coloration yellow, patterned with black, frontal prolongation of head darkened on sides; head orange, with no occipital band, mesonotal praescutum with three polished black stripes that are narrowly bordered by velvety black the central portion of median stripe paler on anterior half, scutellum, postnotum, and pleura yellow; wings with a faint dusky tinge, the stigma and cells Sc and Cu₁ darker, Sc₁ ending a short distance beyond origin of R₄, the latter subequal in length to R₅, cell M₁ broadly sessile; abdominal tergites weakly infuscated medially, the disk of the seventh tergite intensely blackened.

Female.—Length, about 14 millimeters, wing 11

Frontal prolongation of head light yellow above, dark brown on sides, nasus black, conspicuous. Antennae with the scape brown, pedicel dark brown, flagellum black. Head orange, vertical tubercle very weakly notched, no differentiated occipital band.

Pronotum and pleura orange-yellow. Mesonotal praescutum yellow with three polished black stripes, all narrowly bordered by velvety black, anterior end of median stripe with its central portion yellow, this pale color continued caudad for nearly one-half the length of the stripe; lateral stripes straight, scutum yellow, each lobe with two confluent polished black areas that are very narrowly bordered by velvety black, lateral ends of transverse suture infused, scutellum and mediotergite yellow without darkening, the latter with delicate setulae on posterior lateral portions. Pleura yellow, variegated by more reddish yellow areas on the propleura, anepisternum, ventral sternopleurite, and meron. Halteres dusky, the base of stem rostrally pale. Legs with the coxae and trochanters yellow, the fore coxae more reddish yellow; femora brownish yellow, somewhat clearer yellow at base, a little more darkened outwardly, tibiae and tarsi brownish black to black. Wings (Plate I, fig. 2) with a faint dusky tinge: stigma cell Sc, and the narrow cell Cu₁ infuscated, wing tip very gradually and insensibly darker than the remaining ground color of the membrane, veins dark brown. Stigmatal trachea few. Venation: Sc₁ entirely preserved, Sc₁ ending a short distance beyond the origin of R₄, the latter subequal in length to R₅, cell M₁ broadly sessile, m cu at point of departure of vein M₁.

Abdominal tergites weakly infuscated medially, somewhat paler sublaterally at bases of segments, disk of seventh tergite intensely blackened: the borders yellow, the lateral margins more broadly

so stertiles more uniformly yellow. Ovipositor with genital shield obscure yellow, cerci nearly straight.

Habitat: China (Hainan Island).

Holotype, female. Ta Han, altitude 2,500 feet, June 22, 1935 (Gressitt).

The trochæic palette, especially the highly polished præscutal stripes that are narrowly margined with velvety black, is much as in *Neperotoma strabus* Edwards, which differs conspicuously in the occipital band, black central præscutal and anal black scutellum and apical hind femorocubite, and numerous other features. The coloration of the near apical scutal stripe is approached by the otherwise very different Formosan species, *N. parva* Edwards.

CYLINDROTOMINÆ

PHALACROGHERA FARSA BA sp. nov. Plate I, fig. 3.

From a small anterior vertex silvery white, posterior vertex black, prothorax light yellow, mesonotum almost uniformly black, pleura yellow, legs darkened, the tarsi chiefly snowy white, wings narrow, the prearcular region petiolate, median fork of M, cell 2d A reduced to a narrow strip, at domal tergites black, the sternites more greenish brown, ovipositor and genital segment brownish yellow.

Female. Length, about 8 millimeters, wing, 8.

Rostrum yellow, palpi dark brown. Antennæ relatively short, scape and pedicel yellow, flagellum brownish black, flagellar segments passing into a cylindrical, with vertices that much exceed the segments, terminal segment about one half longer than the penultimate. Front and anterior vertex broadly silvery white, posterior vertex black, the occiput, lying to the yellow.

Prothorax entirely light yellow. Mesonotum almost uniformly black, greatly restricting the obscure yellow ground color, præscutum with three confluent stripes, the yellow ground reduced to narrow humeral triangles, median regions of scutellum and scutellum restrictedly pale, median pale narrow margin, with yellow line disk back. Pleura almost penetrating together with the pleural membranes, uniformly pale yellow. Halteres dusky, the knobs infuscated, the base of stem restrictedly yellow. Legs with the coxae and trochanters yellow, femora greenish, usually the tips grayish, passing into brown, tibiae brown, the tips darker, tarsi snowy white, the proximal ends of basitarsi blackened. All legs are detached and the degree of blackening differs in the various legs in some only

the extreme tip, the distal fifth or sixth, is whitened, while in one pair which is presumably the posterior one, the white includes the distal three-fifths.) Wings (Plate 1, fig. 3) with a weak brown large stigma small, long-oval dark brown, veins dark brown, the prearcular veins more yellowish brown. Wings with a long basal petiole. Venation Sc atrophied. Sc ending just beyond fork of Rs, the free tip evident as a faint trace at near middle length of the stigma, m-cu at fork of M, cell 2d A reduced to a narrow strip.

Abdominal tergites black, sternites more greenish brown, ovipositor and genital segment brownish yellow.

Habitat—China (Hainan Island)

Holotype, female Ta Hsiang, altitude 2,500 feet, June 25, 1933 (Gressitt). Paratopotypes 1 female, 1 (sex?), June 21 and 22 1935.

Pholacrocera tarsalva is readily told from all other allies in eastern Asia by the unusually narrow, petiolate wings, very narrow cell 2d A, and the snowy white tarsi. It has no close relative so far made known, the most similar form being *P. metatoma* Alexander (western China). The discovery of a Palearctic element such as the genus *Pholacrocera* at relatively low altitudes in Hainan has provided a surprise in geographic distribution.

LIMONINAE

LIMONINAE

Genus LIMONIA Meigen

Limonia MEIGEN, *Tragers Magazin* 2 (1803) 262

Subgenus GRESSITTOMYIA novum

Characters as in typical *Limonia*, differing most evidently in details of wing venation.

Antennae 15-segmented, flagellar segments oval, the longest verticals or slightly distributed on outer face, about one-third longer than the segments, terminal segment slender, about two-thirds the length of the penultimate. Anterior vertex narrower than the diameter of the scape. Claws with a single short spine near base. Wings (Plate 1, fig. 4) with Sc moderately long, Sc ending beyond two-thirds the length of Rs, Sc₂ close to its tip, Sc₃—R gradually bent strongly caudad, at its outer end reaching vein R₄ to a short f₁ angle element, the free tip of Sc₂ correspondingly lengthened but entirely pale, a supernumerary cross-vein in cell R₂ at near middle length, vein R₃ beyond the cross-

vein strongly sinuous, slightly constricting cell R_2 at near mid-length, a long fusion of veins R_{4+5} and M_{1+2} near γ equal in length to R_3 , completely obliterating $r-m$, cell $1st\ M_2$ narrowed to a point at outer end m being very short to nearly obliterated, outer medial veins deflected strongly caudad, $m-cu$ at or close to fork of M , cell Al at margin unusually wide, anal veins nearly straight, parallel at origin. Male hypopygium (Plate 2 fig. 23) with the dorsal dististyle, dd , well developed slender. Ventral dististyle, vd , small, with a long slender, rostrally prolongation that bears two, long, slender apices on a small tubercle at base, face of style bearing a larger and more conspicuous tubercle that has three, very long, slender setae, these exceeding in length the rostral prolongation of the style.

Type of sex and immature (*Gressittomyia*) *receptum* sp. n. (Oriental Region: Eastern China: Hainan Island.)

The crane fly diagnosed under the above name is one of the strangest in appearance that has ever come to my attention. At first sight the venation seems quite irreconcilable with that of members of the genus *Limonia* the veins beyond the cord being unusually complicated by fusions of elements and the presence of a supernumerary crossvein in cell R_2 . However, there is no doubt that the fly is a member of the great genus *Limonia* and that it is necessary to erect a new subgeneric group for its reception. I take great pleasure in dedicating this subgenus to Mr. J. Linley Gressitt, who has added materially to our knowledge of the Tipulids of eastern Asia.

The most unusual character of the group and the one that separates it from all other subgenera of *Limonia* is the profound fusion of veins R_{4+5} and M_{1+2} , a character suggested by certain other species of the genus, as *Limonia* (*Leona*) *plumosa* (Edwards) where the contact of veins R_{4+5} and M_{1+2} is merely punctiform. Elsewhere in the Tipulidae such a long fusion of veins R_{4+5} and M_{1+2} is rare, being most evident in the tipuline genus *Philygma* Westwood and in the limoniine genus *Trentopoda* Bigot. In other groups of the Limoniinae, a fusion of this nature occurs sporadically in genera such as *Helina* St. Fargeau and *Tenobolous* Osten Sacken but throughout the entire family Tipulidae its occurrence must be held to be decidedly uncommon. The presence of a supernumerary crossvein in the outer radial field is a character likewise possessed by three other subgenera of *Limonia*, namely *Leona* Edwards, *Dapnoptera* Westwood, and *Nedimanshin* Alexander. The group most nearly allied to

Gressittomyia would seem to be *Luon*. For additional details and comparisons the discussion of the subgenera of *Limonia* as given by the writer in an earlier paper* may be consulted.

LIMONIA GRESSITTOMYIA XENOPTERA sp. nov. Plate 1, fig. 4. Plate 2, fig. 2.

General coloration orange, antennae with scape and pedicel black, the flagellum obscure yellow, its outer segments more darkened; head silvery gray, with a capillary dark line on posterior vertex; halteres yellow, the knobs dark red, legs yellow, the femoral tips rather broadly blackened, wings hyaline, the prearcular and costal fields more yellowish, the outer radial, cubital and anal fields more buffy, veins beyond cord conspicuously seamed with brownish black, R_1 extensively fused with M_{1+2} , in very short to virtually lacking; male hypopygium with the rostral spines slender, from a common tubercle at base of prolongation.

Male.—Length, about 7 millimeters; wing, 8.2.

Rostrum and palpi black. Antennae with scape and pedicel black, flagellum obscure yellow, the outer segments passing into brownish yellow; antennal structure as described under subgenus. Head silvery gray, with narrow black median line on posterior vertex.

Entire thorax orange, immaculate. Halteres yellow, the knobs dark brown. Legs yellow, the femoral tips rather broadly black, the amount subequal on all legs; outer tarsal segments infumid. Wings (Plate 1, fig. 4) hyaline, the prearcular region and cells C Sc and R light yellow; outer portion of cell R, cell 1st M_{2+3} and base of R_1 , with outer ends of cells Cu, 1st A, and 2d A, together with basal portion of C, more buffy, veins beyond cord narrowly but conspicuously seamed with brownish black, veins black in the outer fields, paler in the cells basad of cord. Venation as described under the subgenus. Second section of vein R_1 subequal in length to the second section of M_{1+2} . Vein Cu, lying unusually far distant from vein Cu.

Abdomen, including hypopygium deep orange, the pleural membrane weakly infumid, ventral dististyle of hypopygium infuscated. Male hypopygium (Plate 2, fig. 23) with the caudal margin of tergite 9t, transverse, very gently emarginate, the setae at and near border. Dististyle, *d*, with ventromesal lobe large. Dorsal dististyle, *dd*, a slender thickened hook, the acute tip slightly decurved. Ventral dististyle, *vd*, with the body small, shorter than the dorsal dististyle, its rostral prolongation long

*Philipp. Journ. Sci. 40 (1929) 239-248.

and slender. Mesal-apical lobe of gonapophyses very slender. Aedeagus broad at base, narrowed to the knobbed apex.

Habitat.—China (Hainan Island).

Holotype, male, Tu Hsu, altitude 2,500 feet, June 22, 1935 (Gressitt).

The species requires no comparison with any other known member of the genus.

LEUCIA (LEUCIA) LACHRYMOSA sp. n. (Plate I, fig. 2.)

General coloration obscure yellow, the proscutum darkened medially, flagellar segments gradually lengthened to the outermost; eyes broadly contiguous, ommatidia relatively conspicuous, ocellate yellow, variegated by a knobbed area, femora yellow, the tips black, wings leucorrhoeous, the base and costal portion clearer yellow, a restricted dark pattern, including the anal stigma and a cloud at origin of M_2 . Scutellum very long, its emarginated and short squared at origin, medially at fork of M_1 , and arising convergent basally. Abdominal tergites light brown, apices of cerci simple.

Female.—Length, about 7 millimeters; wing, 6.8.

Rostrum brown, palpi a little darker. Antennae dark brown throughout, basal flagellar segments short oval, the outer ones passing through oval to subelliptical, becoming progressively longer outwardly, terminal segment pointed on distal end, about a fifth longer than the penultimate. Extreme apex of flagellar segments glaucous and forming a pedicel, but not suddenly narrowed into a neck. Verticils of outer scame la subequal to or a little longer than the apiculate. Eyes broadly contiguous on anterior vertex, ommatidia rather very large and coarse, posterior vertex brownish gray.

Pronotum brown. Mesonotal proscutum obscure yellow, more infuscated medially, lateral stripes little or scarcely evident; suture of interspaces erect and unusually long. Proscutum with a weak median impressed line, best developed on posterior half, anal lobe dark brown, median area broadly obscure yellow, scutellum obscure yellow on basal portion, the posterior margin broadly infuscated, weakly pruinose. Metathoracic dark brown, pair on lateral portions. Pleura obscure yellow, the propodeum, anepisternum, and axilla sterionemate slightly infuscated. Anterior pair basally, the outer end of stem and the knobs infuscated. Legs with the coxae and trochanters testaceous yellow, femora yellow, the tips rather broadly and conspicuously blackened, tibiae yellowish brown, the tips narrowly and gradually darkened, tarsi passing into brownish black. Wings (Plate I,

fig 5) with the ground color somewhat creamy, the prearcular region and cells C and Sc clearer yellow; stigma subcircular, brown, a very restricted, scarcely evident, dark pattern, appearing as small clouds at origin of R_s and fork of Sc , and as a very narrow and vague apical darkening; cord and outer end of cell 1st M_2 very slightly darkened, most evident as a deepening in the intensity of the veins; veins yellow, darker beyond cord and in the clouded areas. Venation: Sc relatively long, Sc_1 ending about opposite four-fifths the length of R_s , Sc_2 near its tip, R_s weakly angulated and spurred near origin, free tip of Sc_2 and R_2 in transverse alignment; cell 1st M_2 widened outwardly, in about one-half the basal section of M_2 ; m-cu at fork of M , anal veins convergent basally, 2d A very gently sinuous.

Abdominal tergites light brown, scarcely variegated with darker; sternites more yellowish. Ovipositor with valves reddish horn-color, the bases of the hypovalvae blackened, cerci up-curved and acute at tips.

Habitat.—China (Hainan Island).

Holotype, female, Dwa Bi, altitude about 1,500 feet, July 22, 1935 (Gressitt).

The general appearance of the present fly indicates that it is a member of the *pendleburyi* group. It differs from the typical form of this group, *Limonia* (*Limonina*) *pendleburyi* Edwards, of the Federated Malay States, and allied species, in the coloration of the body, legs, and wings and in the details of venation. The angulated and spurred R_s is a peculiar feature in the present group of flies.

LIMONIA (*LIMONINUS*) *QUINQUE-COSTATA* sp. nov. *Plate I. Fig. 5.*

General coloration brownish yellow, the praescutum with four darker brown stripes; antennae black throughout; thoracic pleura brownish yellow, variegated by blackened areas; knobs of halteres dark brown; femora brownish black, the tips narrowly and abruptly yellow, tibiae and tarsi black, wings cream yellow, with a restricted dark pattern, including five small areas along costal border; free tip of Sc_2 and R_2 in approximate transverse alignment, anal veins strongly convergent; cerci bidentate at tips.

Female.—Length, about 10 millimeters; wing, 9.

Rostrum obscure brownish yellow; palpi black. Antennae black throughout; basal flagellar segments globular, passing through short-oval to elongate; terminal segment about one-half longer than the penultimate; longest verticils exceeding

the segments. Front and anterior vertex buffy, the posterior portion of head more fulvous, anterior vertex reduced to a narrow strip that is only a little wider than the diameter of a single ommatidium.

Pronotum dark brown above, brownish yellow on sides. Mesonotal preacutum brownish yellow, the humeral region clear yellow, four darker brown preacutal stripes, the intermediate pair entirely confluent on anterior third of sclerite; a narrow blackish area borders internally the yellowish humeral portion of sclerite, actual lobes dark brown, the median region more grayish, scutellum pale, mediotergite light gray, a little paler medially, more darkened on sides. Pleura brownish yellow, variegated by blackened areas on ventral propleura, dorsopleural membrane, ventral anepisternum, and dorsal sternopleurite. Halteres relatively long, the stem yellow, the knob dark brown. Legs slender, fore coxae dark brown, the middle and hind coxae yellow, femora obscure yellow basally, gradually deepening to brownish black, the tips narrowly but conspicuously yellow, the amount subequal on all legs; tibiae and tarsi black. Wings (Plate I, fig. 6) with the ground color cream yellow, with a restricted brown pattern that is confined to the vicinity of the veins, including a series of five costal areas, distributed as follows: Arcuatus, cell Sc at near one-third the distance to R₂; origin of R₂, fork of Sc; and the small circular stigmal area on vein R₂₊₃, only slightly invading R₂; additional dark seems to many of the veins, including the cord, outer end of cell 1st M₂, more than the basal half of vein R₂₊₃, and outer end of vein 2d A; veins yellow darkened in the clouded areas. Venation: Sc, ending beyond level of m-cu, Sc₂ at its tip, R₂ very gently arcuated about four times the basal section of R₁₊₂, free tip of Sc₂ lying shortly proximad of R₂, cell 1st M₂ of moderate length; m and basal section of M₂ subequal, m-cu at near one-third the length of cell 1st M₂, outer radial and nodal veins nearly straight or only gently curved, anal veins strongly convergent.

Abdominal tergites chiefly dark brown, the caudal portions of the segments a little more reddish brown, sternites brighter. Cerci stout, bidentate at tips.

Habitat.—China (Hainan Island)

Holotype, female Ta Hsien, altitude 2,500 feet, June 21, 1935 (Gressitt)

By Edwards's key to the species of *Lebistes*, the present fly corresponds to couplet 33, differing markedly from all species in the wing pattern and leg coloration. It runs more or less directly to *Limonda (Labnotes) longicrus* (Br. ref.) an entirely different species.

ANTOCHA ANTOCHA FLAVELLA sp. nov. Plate 1, fig. 5. Plate 2, fig. 26.

Size small, wing male, 3.5 millimeters; head light gray; antennae short, flagellum black, thorax and abdomen light yellow, halteres pale yellow, femora yellow, the tips narrowly and gradually infuscated, wings cream-colored, with a restricted pale brown clouded pattern, much more than one fourth its length before the fork of M , male hypopygium with the outer dist. style suddenly narrowed at apex into an acute black spine.

Male. Length about 3.5 millimeters, wing, 1.5.

Rostrum obscure yellow, palpi a trifle darker. Antennae short, scape and pedicel yellowish brown, flagellum black, flagellar segments small, subglobose to short-oval, the outer ones becoming more elongate. Head light gray.

Entire thorax light yellow. Halteres pale yellow. Legs with the coxae and rotunters yellow, femora yellow, the tips narrowly and gradually infuscated, tibiae pale brown, the tips slightly darker, tarsi infuscated. Wings (Plate 1, fig. 7) cream-colored with a vague but evident pale brown pattern, distributed as clouds at origin of R_s , at gm , along cord and outer end of cell 1st M , and at the outer ends of veins R_2 and 1st A , veins yellow, pale brown in the clouded areas. Veins behind R entirely glaucous. Venation. Sc relatively long, Sc ending some distance beyond the fork of R_s , R_2 in actual transverse alignment with r m, cell 1st M about as long as r m, beyond it, basal section of M_2 longer than m , much more than one fourth its length before the fork of M .

Abdomen including hypopygium yellow. Male hypopygium (Plate 2, fig. 26) with the tergite narrowly transverse, the caudal margin approximately straight across or with the median portion a little projecting. Outer dist. style, or relatively long and slender, at apex suddenly narrowed into an acute darkened spine. Inner dist. style broader, the apex obtuse. Phallosome pro-subterled on either side by a flattened very pale plate, the apex of which is obtusely rounded. Outer gonapophysis, g , a simple slender rod, gradually narrowed to an acute point.

Loc. at. China (Hainan Island).

Holotype, male, Dwa Bi, altitude about 1,500 feet, July 21, 1935 (Gressitt).

The present species is most closely allied to *Antocha* (*Antocha*) *facella* Edwards and *A.* (*A.*) *aculosa* Edwards, both from the Malay Peninsula, differing in the gray coloration of the head, color of the antennæ uniformly yellow thorax and abdomen, darkened femoral tips, and details of pattern of the wings. In the last mentioned regard, the fly is more like *aculosa*, which in all other respects is very distinct.

ANTOCHA (*ANTOCHA*) *KHANSINENSIS* sp. nov. (Plate 1, fig. 8; Plate 2, fig. 27)

General coloration pale yellow, the transverse suture of mesonotum narrowly darkened; antennæ yellow, legs yellow, the tips of femora rather narrowly but conspicuously blackened, wings milky white, patterned with brownish black, including the prearcular field and subcostal cell as far distad as the level of origin of R_1 , cord and outer end of cell 1st M_2 narrowly sealed with dark, m-cu more than its own length before the fork of M_1 , male hypopygium with the outer dististyle obtuse at apex, inner gonopophysis acutely pointed, with a pale lateral flange.

Note.—Length about 3.5 to 3.7 millimeters, wing, 4 to 4.4

Female.—Length, about 3.5 millimeters, wing 4

Rostrum yellow; palpi scarcely darkened. Antennæ short, yellow, the outer flagellar segments a trifle darker, flagellar segments oval. Head yellow.

Mesonotum pale yellow, the suture narrowly dark brown, the pattern a little more expanded at lateral ends. Pleura pale yellow. Halteres pale yellow throughout. Legs yellow, the tips of the femora narrowly but conspicuously blackened, the amount unequal on all legs, in the allotype the femora are somewhat less extensively darkened, tibiae more narrowly darkened at tips; tarsi yellow, the outer segments darker. Wings (Plate 1, fig. 8) milky white, patterned with brownish black, in the costal field the latter color alternating with brighter yellow areas, most evident on the costal vein before and beyond the dark stigma, prearcular field and cell Sc as far distad as the origin of R_1 ; blackened, cord and outer end of cell 1st M_2 sealed with blackish; veins pale, darker in the clouded areas, including the outer medial veins. Venation: R_{2+3} only a little longer than R_4 , the latter lying far before the level of r-m, m-cu more than its own length before the fork of M_1 .

Abdomen, including hypopygium, yellow. Male hypopygium (Plate 2, fig. 27) with the outer dististyle, odd, short, and unusual.

ly obtuse at apex. Inner gonapophysis, *g*, terminating in an acute spinous point, the outer margin back from the point expanded into a pale flange that is wider towards the base.

Habitat.—Assam (Khasi Hills)

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935 (Sircar). *Allotopotype*, female. *Paratopotypes*, 2 males.

Antocha (*Antocha*) *khasiensis* is most nearly related to *A* (*A*) *nigribasis* Alexander (western China), differing most conspicuously in the small size and structure of the male hypopygium. It is readily told from all other previously described species of the Himalayan and Indo-Malayan regions by the extreme basal position of *m-cu* and the coloration of the body, legs, and wings.

I am greatly indebted to Mr S. Sircar for the following data on the conditions under which the present series of *Tipulids* were collected: "The specimens were collected by me personally at light (400 C. P. Petromax). It was showering very mildly and from my experience I can say that this is the best time for collecting *Tipulids* at light. Hundreds of these flies came to the light, but I could not save all of them as my net got wet and I had to catch them by hand as they rested on a cloth hung up by the side of the light"—S. SIRCAR.

MEXATOMINI

PSEUDOLIMNOPHILA COMUSULA sp. nov. Figs. 1-5; Plate 1, Figs. 1-5.

General coloration brownish gray; antennae black, wings relatively narrow, almost uniformly tinged with brownish yellow, costal fringe short. *Rs* long, subequal to vein *R*₁; *R*₂ at or close to fork of *R*₃₊₄; cell *M*₁ present; cell 1st *M*₂ long and narrow, subequal to vein *M*₁ beyond it, *m-cu* at or close to fork of *M*.

Male.—Length, about 7 millimeters; wing, 6.5.

Female.—Length, about 8 millimeters; wing, 7.5.

Rostrum dark; palpi black. Antennae brownish black to black throughout, or (male) with the basal half of first flagellar segment paler; flagellar segments subcylindrical to cylindrical, with long conspicuous verticils. Head brownish gray, anterior vertex and orbits clearer gray.

Pronotum dark brownish gray. Mesonotum brownish gray, the praescutum with a slightly darker median stripe, somewhat more intense on cephalic portion, pseudosutural foveae black. Pleura gray, variegated by more blackish gray on ventral anepisternum, sternopleurite, and meron. Halteres pale, the knobs infuscated. Legs with the fore coxae blackened, heavily pruinose, middle and hind coxae much paler, trochanters testaceous.

the remainder of legs yellowish yellow or in cases the femora more yellowish brown. Wings (Plate 1, fig. 9) relatively narrow as compared to *memecussa* almost uniformly tinged with brownish yellow, stigma very faintly darker, veins darker brown. Costal fringe short in both sexes. Venation: Sc ending opposite or just before fork of R_s ; Sc at its tip R_s long nearly straight to very gently arcuated at origin. R_{2+3} eangate, only a little shorter than vein R_3 ; R_2 at or very close to fork of R_4 ; R_{4+5} from one and one-half to twice the length of R_4 ; cell M_1 present about as long as its petiole, cell 1st M_2 relatively long and narrow, its inner end arcuated, the lower face of the cell subequal to or even longer than vein M_1 ; m-cu at or just beyond fork of M ; anterior areus present.

Abdomen dark brown, sparsely pruinose, the hypopygium a trifle brighter. Male hypopygium (Plate 2, fig. 28) with the outer style, *od*, a little longer than the inner style, *id*, straight to apex directed into a slender spine, inner margin before apex with a few denticles. Interbasal rods slender each with a low obtuse flange at near midlength.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hsien altitude 2000 feet, June 14, 1935 (Gressitt). Allotype, female, Dwa Bi altitude about 1500 feet, July 21, 1935 (Gressitt).

Pseudolimonophila concussa is very closely allied to *P. membranacea* (Alexander) of Japan and China, and may prove to be only a more southern race of the latter. The unusually narrow wings, with narrow cell 1st M_2 , serve to separate the fly from the usual, larger and more vigorous *memecussa*.

PSEUDOLIMNOPHILA SETIGESTATA sp. nov. Plate 5, fig. 9.

General coloration of mesonotum uniformly dark brown, the pleura a little paler; antennae black throughout, flagellar verticils very long, legs brownish black; wings a faint brown tinge, costal fringe (male) unusually long and dense, R_2 at or before fork of R_{3+4} , cell M_1 lacking; m-cu a short distance beyond fork of M ; abdominal tergites dark brown, the sternites more brownish yellow.

Male.—Length about 5 millimeters, wing, 55.

Rostrum obscure yellow to yellowish brown, palpi black. Antennae black throughout, flagellar segments subcylindrical with long verticils that greatly exceed the segments. Head brownish black above, the anterior vertex and orbits a very little paler; anterior vertex relatively wide, exceeding twice the diameter of scape.

Pronotum and mesonotum a most commonly dark brown, the pleura a little paler. Halteres dark, the base of stem very narrowly paler. Legs with the coxae brown, trochanters yellowish brown, femur and tibiae brownish black. Wings (Plate 1, fig. 10) with a faint brownish tinge, stigma oval, slightly darker brown, veins medium brown, much darker than the ground. Costal fringe (male) unusually long and dense, the setae longer than the width of cell Sc_1 . Venation: Sc_1 ending shortly before level of fork of R_2 , Sc_2 near its tip, R_1 variable in position, in the paratype being some distance before the fork of R_{3+4} , veins R_{1+2} , R_3 and R_{3+4} in this case being subequal in length; in the holotype R_3 is at or very close to the fork of R_{3+4} , eliminating or greatly reducing the latter element; veins R_3 and R_4 diverging rather conspicuously, cell R_5 at margin being considerably more extensive than cell R_2 ; cell M_1 lacking, $m-cu$ a short distance beyond fork of M ; anterior arculus present.

Abdominal tergites dark brown, the sternites and hypopygium more brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Tu Han, altitude 2,500 feet, June 21, 1935 (Grossitt). Paratype, male, Dwa Bi, altitude about 1,500 feet, July 22, 1935 (Grossitt).

The long dense costal fringe of the male (though possibly not of the still unknown female) is much like that of the otherwise very distinct *P. costofimbriata* Alexander, of southern India, the latter species having cell M_1 present and very deep. *Pseudolimnophila descripta* Alexander, of the mountains of Formosa, has cell M_1 lacking, but differs from the present fly in other venational details. The female sex of the latter species has the costal fringe short, but the male is still unknown.

Genus HEXATOMA Latreille

Hexatoma LATREILLE, Gen. Crust. et Ins., 4 (1808) 260.

Subgenus EUTEXATOMA n. sp.

Characters as in the subgenus *Eriocera* Macquart, having four branches of radius and four of media reaching the wing margin, cell 1st M_2 closed. Supernumerary crossveins in each of cells R_3 , R_4 , and R_5 in approximate alignment (Plate 1, fig. 11).

Type of subgenus.—*Hexatoma* (*Eutexatoma*) *triphaena* sp. nov. (Oriental Region: Eastern China, Hainan Island).

The new subgenus is based on the presence of three strong supernumerary crossveins in the outer radial field of the wing, a character paralleled by other subgeneric groups in the allied

hexatomine genera *Adelphomima* Bergroth and *Limnophila* Marquart. The present fly is of very strange appearance, the outer radial field giving one a definite impression of resemblance to the wing of a scorpion fly (Mecoptera).

HEXATOMA (HEXATOMA) TRIPRAENA sp. nov. Plate 1, fig. 11

General coloration of thorax brownish yellow, the praescutum with three confluent darker brown stripes, antennal flagellum yellow, femora yellow, the tips narrowly blackened, wings dark brown, the veins narrowly but conspicuously bordered by yellow, wing tip more broadly yellowish, small paired hyaline droplets near outer ends of cells R_1 and R_2 , respectively, supernumerary crossveins in cells R_1 , R_2 , and R_3 , cell M_1 present, m-on at near two-thirds the length of cell 1st M , abdominal tergites reddish brown, the hypopygium brownish yellow.

Male. Length, about 20 millimeters, wing, 15.

Rostrum dark brown, palpi short, brown. Antennae 7-segmented, scape and pedicel yellowish brown, flagellum yellow, the outer segments a little darkened, flagellar segments cylindrical gradually decreasing in length outwardly. Head brown, vertical tubercle entire, its margin rounded.

Pronotum brown. Mesonotal praescutum brownish yellow, with three darker brown stripes that are confluent behind, posterior sclerites of notum chiefly brownish black. Pleura obscure yellow, variegated by dark brown on the ventral anepisternum, ventral sternopleurite, meson, and pleurotergite. Halteres brownish yellow. Legs with the coxae light brown, trochanters more reddish brown, femora yellow, the tips narrowly blackened the amount subequal on all legs and including about the distal sixth or seventh of the segment, tibiae brown, the tips narrowly blackened, tarsi black. Wings (Plate 1, fig. 11) with the ground color dark brown, the veins narrowly but conspicuously bordered by yellow, wing tip more extensively of the same color, two small paired hyaline droplets near outer ends of cells R_1 and R_2 , beyond the supernumerary crossveins of these cells cell 1st A more grayish cell 2d A yellow, margined outwardly with gray, vague linear pale streaks in central portions of cells R_1 , M , and M_1 , veins yellow to brownish yellow, contrasting with the dark ground. Scattered macrotrichia on all outer radial branches. Venation Sc_1 arising about opposite R_2 , $R_2 + 4$ a little shorter than the basal section of R_1 , R_{1+2} longer than R_{2+3} , the supernumerary crossveins in the radial field slightly variable in position, those in cells R_1 and R_2 more oblique

than the one in cell R_{5+6} ; in the left wing of type, the vein in cell R_5 runs more than its own length beyond the one in cell R_{5+6} , whereas in the right wing the elements are nearly interstitial, as illustrated, cell M_1 present, $m-cu$ much longer than the distal section of Cu_1 , placed at near two-thirds the length of cell 1st M .

Abdominal tergites deep reddish brown, without differentiated basal coloring on the individual segments; basal and subterminal segments somewhat darker; sternites clearer reddish brown; hypopygium brownish yellow.

Habitat.—China (Hainan Island).

Holotype, male, Liamui, altitude about 1,200 feet, July 31, 1935 (Gressitt).

This rather remarkable crane fly requires no comparison with any previously described member of the genus, the subgeneric character of three supernumerary crossveins in the outer radial field being quite unique within the group.

HEXATOMA (HEXATOMA) TUBERCLATA sp. nov. Plate I, figs. 12.

Belongs to the *perennis* group: general coloration of thorax dull gray, the prescutum with four scarcely differentiated plumbeous-gray stripes that are narrowly bordered by blackish; setae of thoracic dorsum short and inconspicuous; a median series of from three to five small tubercles at cephalic portion of prescutum, halteres and legs black, wings dark brown, with an oval yellow discal area before cord; costal vein in both sexes with abundant short setae; cell M_1 present, abdominal tergites purplish blue, with about the outer third of the segments dull black; hypopygium and shield of ovipositor orange.

Male.—Length, about 19 to 24 millimeters, wing 15 to 19.

Female.—Length, about 21 to 25 millimeters, wing, 16 to 17.

Rostrum dark gray; palpi black. Antennae short in both sexes, in male 7-segmented, in female 11-segmented, scape and pedicel black, sparsely pruinose, flagellum obscure yellow to yellowish brown. Head dull black, a little more grayish on front and on posterior orbits, vertical tubercle entire, unusually slender especially in male. Vestiture of head of moderate length.

Pronotum dull dark gray, the lateral angles of the scutum produced into tuberculate lobes; scutellum with a deep median meson on anterior border. Mesonotal prescutum dull gray, with four scarcely differentiated plumbeous gray stripes that are narrowly bordered by blackish, anteromedian portion of prescutum elevated into from three to five small tubercles arranged in a longitudinal row, posterior sclerites of notum dull plumbeous gray. Vestiture of thoracic dorsum unusually short and sparse.

Pleura entirely blackened, very sparsely pruinose. Halteres short, black throughout. Legs entirely black. Wings (Plate 1, fig. 12) dark brown; the anal cells a little paler, an oval yellow discal area before the cord, occupying the outer end of cell R and adjoining parts of cells R and M, with a slight invasion of the extreme base of cell 1st M., veins dark reddish brown, brighter in the yellow area, some of the veins adjoining the discal brightening very narrowly and insensibly bordered by yellow. Costa with abundant small setae in both axes, outer branches of R with trichia, more sparse and scattered on R., a few scattered trichia on vein M and, in cuxca, on M. Venation: Sc, ending shortly beyond R, its angulation to spurred very close to origin, R₁₊₂ much longer than R₃₊₄, the latter subequal to basal section of R, cell M present; m-cu at near two-thirds to three-fourths the length of cell 1st M.

Abdominal tergites two to seven inclavate, brilliant purplish blue, the caudal margins of the segments dull black, involving about the outer third of the sclerite, sternites more uniformly blackened, the basal rings less brilliantly blue, male hypopygium and shield of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, male, Fan Ta, altitude about 1,250 feet, June 8 1935 (Gressitt). Allotype, female Ta Hien altitude 2,000 feet June 11, 1935 (Gressitt). Paratypes, 2 males with the allotype, June 12 and 13, 1935, 1 male 1 female, Lianul, altitude about 1,200 feet, August 1 and 2 1935 (Gressitt).

By Edwards's key to the Old World species of *Arizocera*,¹ the present fly runs to couplet 87 and agreeing with species beyond this point by the lack of yellow or orange areas on the intermediate abdominal segments, as well as in several other features. The fly is quite distinct from all other species known to me.

NERATOMA (NERATOMA) NINTITHOMAS sp. nov. (Plate I, fig. 13)

General coloration deep velvety black; head and thorax with long, coarse erect setae; halteres and legs black; wings strongly blackened, with a narrow white discal area before the cord, numerous macrotrichia on veins beyond cord, cell M, lacking; m-cu beyond outer end of cell 1st M. on vein M; abdomen velvety black, segments two, four, and five with leaden-colored basal bands, genital shield black, valves of ovipositor orange.

Female.—Length, about 16 millimeters, wing 12.5.

Rostrum black, sparsely pruinose, palpi black. Antennae (female) 11-segmented, scape and pedicel black, flagellum brownish black, the measures of the more proximal segments narrowly paired, flagellar segments with long coarse vertical segments gradually decreasing in length outwardly, the terminal a little longer than the penultimate. Head dark gray, with very long, coarse, black setae.

Thorax uniformly velvety black, with long coarse setae especially conspicuous on the dorsum. Halteres and legs black throughout. Wings (Plate 1, fig. 13) strongly blackened, the anal cells much paler, grayish, a narrow white discal area before cord, including cells R_1 to Cu , inclusive, the last area narrowly separated from the remainder of the band by a narrow dark seam adjoining vein Cu in cell M , the gray anal cells variegated by more infuscated area at near midlength and by more brightened areas near outer end of cell 1st A and basal portion of cell 2d A, veins dark, paler in the discal brightening. Costal fringe short but abundant, longer and more conspicuous basad of h., macrotrichia of veins beyond cord abundant, including all veins from R_1 to Cu , inclusive more sparse and restricted in the medial and cubital fields. Venation: Sc_1 ending nearly opposite R_2 , R_{1+2} much longer than either R_{3+4} or R_{2+3} , medial veins very faint and difficult to trace, cell M_1 lacking, m-cu erect, placed beyond the outer end of cell 1st M_2 on vein M_1 .

Abdomen velvety black, segments two, four, and five with leader-colored or plumbeous basal bands, segments three, six, and seven uniformly blackened, sternites black, genital shield black, valves of ovipositor orange.

Habitat.—China (Hainan Island).

Holotype, female. Liana, altitude about 1,200 feet, July 31, 1935 (Gressitt).

Hexatoma (*Exocera*) *harti* there is one of rather numerous species discovered in recent years that runs to *H. (E.) harti*.

Walker, by means of existing keys to the subgenus. It is distinguished from others in this particular group of forms by the coloration of the wings and abdomen, the venation, as the deep fork of cell R_2 and direction and position of m-cu, and by the unusually long erect pubescence of the head and thorax. In the latter feature the species agrees well with *H. (E.) villosa* Edwards (Perak), which has an apical pale crescent on the wings, additional to the pale discal area.

ELEPHANTOMYIA (ELEPHANTOMYIDÆ) ANGUSTICELLULA sp. nov. Plate L fig. 1

General coloration of mesonotum brownish yellow, the pleura a trifle more infuscated, rostrum approximately one-half as long as remainder of body, basitarsus with proximal two-thirds black, the distal third snowy white, wings subhyaline, cell Sc stigma and outer end of cell R_2 uniformly and continuously infuscated, basal section of R_2 almost in longitudinal alignment with R_3 , cell 2d A very short and narrow, abdominal tergites inconspicuously bicolorous, obscure yellow, the caudal portions of the segments blackened, the outer three segments uniformly blackened.

Male.—Length, excluding rostrum, about 10 millimeters; wing 6.5; rostrum alone, 5.

Rostrum black throughout, approximately one-half as long as remainder of body. Antennæ black, flagellar verticils long and conspicuous. Head brown, the orbits narrowly light gray; anterior vertex relatively wide, a little greater than the diameter of scape.

Mesonotum uniformly dull brownish yellow, the pleura a trifle more infuscated. Halteres obscure, the knobs a trifle more dusky. Legs with the coxæ weakly infuscated, trochanters brownish yellow, femora brownish black, a little brightened basally, deepening to black at tips; tibiae black, basitarsi black the distal third snowy white, remainder of tarsi snowy white, the terminal segment infused. Wings (Plate I, fig. 11) subhyaline, cell Sc, stigma and adjoining narrowed outer portion of cell R_2 uniformly and continuously infuscated, veins black. Venation: R_1 strongly arcuated; anterior branch of R_3 at origin arcuated in almost the same degree as R_3 , its distal portion gently sinuous and running close to R_1 , basal section of vein R almost in longitudinal alignment with the end of R_3 , a little shorter than $r-m$, cell 1st M_2 longer than vein $4l$, beyond it, $m-cu$ about one-half its length beyond the fork of M , cell Cu gradually widened to margin, vein 2d A short, the cell unusually short and narrow.

Abdominal tergites obscure yellow, blackened medially and caudally, the outer three segments uniformly blackened, sternites more uniformly obscure yellow, the caudal portions of the segments more infuscated.

Habitat.—China (Hanan Island).

Holotype, male, Ta Han, altitude 2,000 feet, June 7, 1931 (Greenall).

Elephantomyia (*Elephantomyia*) *angusticellula* is generally similar to several other species of the subgenus in the Oriental and eastern Palearctic faunal regions, such as *E* (*E*) *acronota* (Brunetti), *E* (*E*) *fuscumarginala* Enderlein, and *E* (*E*) *uniformis* Alexander, differing from all in the body coloration and the details of venation, especially the very short and narrow cell 2d A. In the last mentioned regard, the nearest approach to the present fly is found in *uniformis*.

ERIOPTERINI

TRIXIPORUS (*ORONOMA*) *WAINANICA* sp. nov. Plate 1, fig. 15.

Thorax entirely orange-yellow, immaculate, antennae black throughout, femora obscure yellow basally, passing into brown thence dark brown; tarsi paling to yellowish brown; wings whitish subhyaline, the prearcular and costal regions clear light yellow, a restricted dark pattern, including the wing tip and a seam along vein Cu_1 , R_2 at or beyond the fork of R_{3+4} , abdomen black the bases of the intermediate segments vaguely brightened.

Male.—Length, about 9 millimeters; wing, 72.

Female.—Length, about 11 millimeters, wing, 83.

Rostrum brown; palpi black. Antennae black throughout flagellar segments cylindrical, the verticils shorter than the segments. Head brownish yellow; anterior vertex reduced to a narrow strip, carinate, the ridge extending caudad onto the posterior vertex.

Pronotum yellow. Mesonotum and pleura entirely deep orange-yellow, immaculate. Halteres with basal third of stem obscure yellow, the outer portion and knob blackened. Legs with the coxae and trochanters yellow; femora obscure yellow basally passing into brown, the tips gradually deepening to dark brown, tibiae dark brown; tarsi paling to yellowish brown, bases of femora with a series of from eight to ten small black spines, posterior tibiae near apex with about four powerful black setae, the outermost shorter. Wings (Plate 1, fig. 15) whitish subhyaline, the prearcular and costal regions clear light yellow stigma dark brown; paler brown washes include the extensive wing tip, vague seams along cord, a broad, conspicuous seam in cell M adjoining vein Cu_1 , and the axillary region, veins brownish black, luteous in the yellow basal and costal portions. Venation: R_2 at or beyond fork of R_{3+4} ; m-cu at or before (near) fork of M; apical fusion of veins Cu_1 and 1st A slight cell 2d A wide.

Abdomen black, the bases of the intermediate tergites very vaguely brightened by brownish yellow, genitalia of both sexes obscure yellow.

Habitat.—China (Hainan Island).

Holotype, male Tu Han, altitude 2,500 feet, June 22, 1935 (Gressitt). A holopotype female, June 23, 1935 (Gressitt).

Trentepohlia (*Mongonia*, *Asiatica*) is allied to *T. 31* *arvicola* Alexander and *T. (M.) flavicollis* Edwards, of Java, especially to the former. The differently patterned thorax, legs, and wings and the uniformly darkened halteres, readily separate the present fly from these somewhat similar species. By my latest key to the Philippine species of *Trentepohlia* the fly runs to *T. (M.) carbonipes* Alexander, of Mindanao, a very different fly.

MONONTIA (PTILOSTENA) HAINANENSIS sp. nov. (Plate 1, fig. 15).

General coloration of mesonotum dark brown, more reddish brown on sides, knobs of halteres darkened, femora yellow, with a narrow but conspicuous brownish black ring just before apex, wings yellow, sparsely patterned with dark brown, stigma oval, extending distad to vein R_3 , vein R_1 gently arcuated, abdominal tergites black, the caudal margins narrowly yellow.

Female.—Length, about 5.6 millimeters, wing, 5.

Rostrum and palpi dark. Antennae with scape brownish yellow, pedicel yellow, flagellum broken. Head brownish gray.

Pronotum obscure yellow above, darker on sides. Lateral pretergites light yellow. Mesonotal praescutum dark brown medially, more reddish brown on sides, the humeral region with a very restricted area of light yellow, pseudosutural foveae brownish black, scutum dark brown, scutellum testaceous-brown, mediotergite dark, with a pruinose gray triangle on cephalic portion the point directed backward. Pleura reddish brown, the dorsal sclerites somewhat darker. Halteres pale, the knobs darkened. Legs with the coxae testaceous-brown, trochanters testaceous-yellow, femora yellow, with a narrow but conspicuous brownish black ring just before apex, tibiae obscure yellow, the tips narrowly blackened, tarsi brownish yellow, darker outwardly. Wings (Plate 1, fig. 16) with the ground color yellow, sparsely patterned with dark brown, the areas including a small areolar darkening, origin of R_3 , cord and m-cu, stigma and a

paler brown submarginal wash on outer ends of cells R_3 and R_4 , no darkening at outer end of vein 2d A, wing tip deeper yellow than the remainder of ground. stigmal area oval, extending distad to vein R_4 or virtually so, veins yellow darker in the infuscated areas. Costal fringe relatively long and conspicuous, numerous macrotrichia on all veins beyond level of m-cu and on veins M and 1st A nearer the wing base. Venation Sc_1 ending about opposite one fourth the length of the strongly angulated to weakly spurred Rs , R_{1+2} and R_3 close together at wing margin, vein R_4 gently arcuated, not strongly recurved as in *teramshu* and a lesser medial fork about one third longer than its petiole, m-cu less than twice its length before fork of M.

Abdominal tergites black, the caudal margins of the segments narrowly but conspicuously yellow, sternites more brownish yellow, the yellow apices not so clearly defined.

Habitat—China (Hainan Island).

Holotype, female Ta Han altitude 2,500 feet, June 21, 1935 (Gressitt).

The nearest described allies are *Gonomyia* (*Ptilostena*) *longipennis* Alexander (Loochoo Islands) and *G. (P.) teramshu* Alexander (Japan, eastern and southern China), which differ in the coloration of the body, the uniformly pale femora, and the details of wing pattern and venation, notably the more strongly arcuated vein R_4 .

GONOMYIA LIPOPHLEES CONQUISITA sp. nov. Plate I, fig. 11.

Belongs to the *sulphurella* group, allied to *tuberculosa*, general coloration of notum dark gray, scutellum obscure yellow, darkened medially at base, femora yellow, with a narrow, dark brown subterminal ring the yellow apex subequal in extent or slightly wider, wings tinged with grayish, the costal border and apex whitened, abdominal tergites black, the caudal borders of the segments narrowly yellow.

Female.—Length, about 5 millimeters, wing, 4.

Rostrum and palpi black. Antennae with scape and pedicel yellow above, darker on lower surface, flagellum broken. Head above obscure yellow, the central portion of posterior vertex more infuscated, its sides and the genae again darkened.

Pronotum yellow, darker on sides, pretergites light yellow. Mesonotal praescutum and scutum dark gray, pseudosutural foveae darkened, inconspicuous against the ground, scutellum obscure yellow, the basal portion darkened medially, postnotum gray. Pleura brownish black with a conspicuous whitish longitudinal stripe extending from the fore coxae to the base of

abdomen, ventral sternopleurite and meron darkened, pteropleurite and pleurotergite somewhat paler brown than the anterior sclerites. Halteres yellow, the knobs weakly darkened basally. Legs with the fore coxæ whitened, middle and posterior coxæ darker basally, the tips pale; femora yellow, with a narrow, dark brown, subterminal ring, this subequal to or narrower than the yellow apex; tibiae yellow, tarsi broken. Wings (Plate 1, fig. 17) with a grayish tinge, the costal border and apex whitened, the latter including the distal ends of cells R_4 , R_5 and $2d\ M$ as far basad as the level of the tip of vein R_4 , stigma small, oval, brown, interrupting the white costal border, restricted darker areas at areolus, origin of R_5 , along cord and outer end of cell $1st\ M_2$, and as a seam on vein R_3 ; veins pale darker in the infuscated areas, more whitened in the pale portions of the wing. Costal fringe pale, relatively long and conspicuous, rather numerous macrotrichia on veins R_{1+2+3} , M_1 , distal section of R_5 , and distal sections of M_{1+2} and M_3 ; a few trichia at extreme outer end of vein $2d\ A$. Venation: Sc_1 ending opposite origin of the long R_5 , Sc_2 close to its tip; R_5 subequal in length to stem of cell R_3 ; vein R_3 very short, perpendicular cell R_2 at margin considerably more extensive than cell R_3 , vein R_4 rather strongly upcurved at margin; m-cu shortly before fork of M .

Abdominal tergites black, the caudal borders of the segments narrowly yellow; sternites somewhat more grayish black, the pale borders narrower. Cerci horn-colored, darkened basally.

Habitat.—China (Hainan Island).

Holotype, female, Ta Han, altitude 2,500 feet, June 21, 1937 (Gressitt).

Gonomyia (*Lipophleps*) *conquisita* is readily told from other members of the group that are closely allied to *nubeculosa* (de Meijere), including *pallidistigmata* Alexander, by the narrow brown femoral rings. In all species of the group hitherto described, these annuli are black, very broad, and preceded and followed by narrow whitened rings.

Gonomyia (*Lipophleps*) *pallidistigmata* sp. nov. Plate 1, fig. 18; Plate 2, fig. 23.

Allied to *bicolorata*; femora brown, the extreme tip abruptly pale, wings suffused with brown, the costal and apical portions narrowly white, the remainder of membrane more or less variegated by paler areas; stigma oval, dark brown; Sc short, Sc_1 ending before origin of R_5 a distance nearly equal to the length of the latter vein, male hypopygium with two dististyles, the outer one bilobed, its outer arm a long, slender, simple rod, the

inner arm a densely hairy cushion, inner style terminating in a curved spine and bearing a second very long spine on outer margin at near midlength.

Male. Length, about 3.2 to 3.4 millimeters, wing, 3.6 to 3.8

Female. Length, about 4 millimeters, wing, 4

Rostrum and nape black. Antennae with the scape and pedicel yellow, flagellum black, flagellar segments (male) with unusually elongate verticils. Head chiefly yellow, badly flexed in types, but apparently with central darkening on posterior vertex.

Pronotum and lateral pretergites pale yellow, the former darkened on sides. Mesonotal praescutum and scutum almost uniformly dark brown, the pseudosutural foveae black, scutellum black basally, obscure brownish yellow behind, mediotergite blackened, the anterolateral portions obscure yellow. Pleura chiefly dark brown, somewhat paler dorsally on the pteropleurite and pterotergite and ventrally on the ventral sternopleurite, a broad white longitudinal stripe extends from the fore coxae across the dorsal sternopleurite, ventral pteropleurite and meral area to base of abdomen. Halteres yellow, the lower face of knob dusky. Legs with the coxae pale, their basal portions dark brown, the fore coxae more uniformly whitened, trochanters testaceous-yellow, femora brown, somewhat darker outwardly, the extreme tip abruptly pale, tibiae and tarsi brown. Wings (Plate 1, fig. 18) almost uniformly suffused with brown, the costal border and apex conspicuously china white, the degree nearly uniform throughout the area except before the stigma where the pale crosses R_2 into cell R , stigma oval, dark brown, dusky ground color slightly variegated by paler areas, as in many allied forms, veins brownish yellow, paler, almost white, in the anterior pale portion. Costal fringe sparse, but long and conspicuous. Venation. Sc short, Sc ending far before origin of R_2 , the distance on costa nearly as long as R_2 alone, branches of R_2 divergent, cell R narrowed at margin, $m-cu$ a short distance before fork of M .

Abdominal tergites dark brown, the posterolateral angles yellow, more broadly and conspicuously so on outer segments, subterminal segment more uniformly darkened, hypopygium yellowish brown. Male hypopygium (Plate 2, fig. 29) with two terminal dististyles, outer style, ed , knobbed, the outer arm a simple, slender, blackened rod, a little longer than the basistyle, inner lobe more than one half as long as the outer, fleshy, the distal half with abundant yellow setae. Inner dististyle, id

small, terminating in a slender, curved, acute spine; on outer margin at near midlength produced into a second, very long, nearly straight spine that exceeds the style in length, its base dilated. Phallosome, *p*, with two divergent subapical lobes, the tips with microscopic setæ.

Habitat.—China (Hainan Island).

Holotype, male, Ta Hian, altitude 2,500 feet, June 23, 1935 (Gressitt). Allotype, female, Ta Hian, altitude 2,000 feet, June 19, 1935 (Gressitt). Paratype, male, Liamui, altitude about 1,200 feet, August 3, 1935 (Gressitt).

The nearest described ally is *Gonomyia* (*Lipophleps*) *bicolorata* Alexander (Lazon, Hainan), which is similar in general appearance but the structure of the male hypopygium is very different.

GONOMYIA (LIPOPHLEPS) SILVIVIRENS sp. nov. Plate 1, fig. 19; Plate 2, fig. 20.

Mesonotum brownish black, sparsely pruinose, scutellum yellow, darkened medially at base, thoracic pleura with a longitudinal yellow stripe, femora infuscated, with a broad, blackish, subterminal ring, preceded and followed by narrow, clearer yellow annuli, tibiae and tarsi black, wings grayish subhyaline, the costal border whitened, the disk with extensive brown clouds; Sc short. male hypopygium with the outer dististyle a long blackened rod, its distal fifth expanded and densely set with a cushion of spines.

Male.—Length, about 3.5 millimeters, wing, 36 to 37.

Rostrum obscure brownish yellow, palpi black. Antennæ black, the scape more or less brightened. Head orange-yellow, variegated by brownish black on central portion of disk.

Mesonotum brownish black, sparsely pruinose; pseudosutural foveæ black, scutellum yellow, darkened medially at base, postnotum more heavily pruinose. Pleura brownish black, the dorsal pteropleurite and pleurotergite more infuscated; a relatively narrow but conspicuous, pale yellow, longitudinal stripe extending from the fore coxæ to the base of abdomen, passing beneath the root of halteres, this stripe narrowly bordered dorsally by a dark stripe. Halteres yellow, most of the knobs infuscated. Legs with the coxæ darkened basally, paler at tips, trochanters brownish testaceous; femora infuscated, the distal third more yellowish, inclosing a broad, more-blackened subterminal ring, the actual tip and postmedian pale annulus much narrower, posterior femora with long erect setæ; tibiae and tarsi brownish black. Wings (Plate 1, fig. 19) with the ground color grayish subhyaline, variegated by more brownish clouds near wing base,

across outer ends of cells R to 1st A inclusive, and beyond the cord costal border and conspicuous areas before and beyond stigma white, stigma oval, pale brown, veins pale brown, still paler in the brightened costal portions darker along cord. Costal fringe relatively long and conspicuous, trichia of veins beyond cord relatively abundant. Venation: Sc short, Sc₁ ending some distance before origin of Rs, the distance on C being about two-thirds the length of Rs alone, r-m long, gently arcuated.

Abdomen blackened, the caudal borders of both tergites and sternites restrictedly paler, hypopygium large, more chestnut brown, the conspicuous outer dististyle black. Male hypopygium (Plate 2, fig. 30) with the two dististyles terminal in position. Outer dististyle rod, a long, nearly straight, blackened rod that is considerably longer than the basistyle, on apical fifth a little dilated and bearing a dense brush or cushion of spines, outer surface of stem of style with abundant spinous points or teeth. Inner dististyle, dististyle simple, long, and slender. Phallosome, *p*, not clearly evident in material studied, consisting of flattened pale cushions and a single, acute, smooth black spine.

Habitat—Assam (Khasi Hills).

Holotype male, Cherrapunji, altitude 4,000 feet, August, 1885, at night (Sircar). Paratopotype, 2 males.

By Edwards's key to the Oriental species of *Lipophleps*,⁴ the present fly runs to *subnebulosa* Edwards, a quite different species with the wing pattern distinct. As usual in the genus the male hypopygium offers the chief feature for the separation of the species from allied forms.

COMONYIA LIPOPHEPS SIRCARI sp. nov. Plate I, Fig. 22. Plate I, Fig. 21.

General coloration dark brownish gray, scutellum obscure yellow on posterior border, pleura with a light yellow longitudinal stripe, legs dark brown, posterior femora with a series of more than a score of erect setae, wings with a faint brown tinge, the disk slightly variegated by more grayish subhyaline areas, Sc short, male hypopygium with the outer dististyle a simple rod, inner dististyle bearing two long, slender pale arms, each tipped with a small blackened spine. Phallosome with appressed spinulose points.

Male—Length about 3 millimeters, wing 3.3.

Rostrum and palpi black. Antennae black throughout. Head above orange-yellow, the central portion of vertex more darkened.

⁴ Journ. Fed. Malay St. Mus. 14 (1928) 104-105.

Pronotum and anterior lateral pretergites yellow. Mesonotal pronotum and acutum uniformly dark brownish gray, without markings; scutellum clearer yellow on the border or border, broad, darkened medially at base; postnotum obscure yellow on cephalic half, the posterior part on darkened. Pleura with the discopleural membrane and most of prepecturite and pterostegite obscure yellow, the more ventral plates on brownish gray with a conspicuous light yellow longitudinal stripe extending from and including the fore coxa, reaching the base of abdomen. Halteres dark, with most of the knob light yellow. Legs with the fore coxa yellow, the remaining coxa and all the chambers more testaceous; remainder of legs dark brown; posterior femora with an evenly spaced series of more than a dozen of long erect setæ additional to the usual appressed vestiture. Wings (Plate 1, fig. 5) with a faint brownish tinge, the prearcular and costal portions more rufous yellow, stigmas small, oval, a little darker than the ground color; *cu-a* is segregated by more grayish subhyaline areas in the posterior half of wing; the radial field more uniformly pale brown, veins pale brown, a little lighter in the costal and prearcular fields. Costa fringe moderately long, at base with setæ very sparse and tiny; anterior branch of *R*₁ without trichæ; *W* and *a*, outer branches of *M* with numerous trichæ. Venation: *Sc* short, *Rs*, ending some distance before origin of *Rs*, the distance as *C* equal to about two-thirds the length of *Rs*, *Rs* only a little shorter than its anterior branch, the latter directed strongly cephalad, as well *R*, at margin is very wide, more close to fork of *M*.

Abdominal tergites dark brown, the mesones particularly pale; sternites and hypopygium more yellowish. Male hypopygium (Plate 2, fig. 3) with two distyles, both terminal in position. Outer style of a simple suboval rod the base with a small terminal flange the center thickened at the base a little wider, the apex obtuse. Inner style of bearing two, long, slender, pale arms each tipped with a small hooked or beak-shaped a little longer than the other, the latter bearing two spines on one side and only one on the other (of the unique type probably anomalous, and the rod itself may be normally unspined). Phallosome appearing as two divergent flattened weak horns that run out into smooth black apices, the so-called microscopically or minute and provided with appressed spinulose points.

Habitat: A-nam Khazi Hills.

Locality: A-nam Cherrapunji, altitude 4000 feet, August, 1936, at night (Singer).

I take great pleasure in naming this distinct crane fly in honor of the collector of this interesting series of Tipulidæ from the Khasi Hills, Mr. S. Sircar. The species is readily distinguished from other, generally similar, allied species in this faunal area, such as *flavomarginata* Brunetti and *nissoria* sp. nov., in the structure of the male hypopygium.

CONOMYIA (*LIPOPHLEPS*) *KHESORIANA* sp. nov. Plate 1 fig. 21. Plate 2 fig. 22.

General coloration dark brown, scutellum obscure yellow, darkened medially at base; pleura with a clear yellow longitudinal stripe; knobs of the halteres darkened, legs brownish black, wings with a faint brown tinge, the costal border whitened, stigma and narrow seams along cord and outer end of cell 1st M. vaguely seamed with pale brown. Sc short, abdominal tergites uniformly dark brown, the sternites and hypopygium yellow, male hypopygium with both dististyles terminal in position, the inner at apex produced into a long yellow arm that is tipped with a small black spine and bears a single very long bristle that is longer than the arm itself.

Male.—Length, about 2.7 millimeters; wing, 3.

Rostrum and palpi black. Antennæ with the scape black, pedicel chiefly orange, flagellum black. Head light yellow, the central portion of vertex weakly darkened.

Pronotum and the lateral pretergites light yellow. Mesonotal praescutum and scutum dark brown, the surface sparsely pruinose, pseudosutural foveæ reddish brown, scutellum obscure yellow, the base darkened; mediotergite extensively obscure yellow, darkened behind and on sides. Pleura with dorsal sclerites and membrane brownish yellow; a broad, clear yellow, longitudinal stripe extending from the fore coxæ to the base of abdomen, passing beneath the halteres, narrowly bordered above by darker brown; ventral sternopleurite darkened. Halteres with the stem dusky, the knob yellow. Legs with the coxæ testaceous, the fore pair somewhat clearer, remainder of legs brownish black; posterior femora with moderately erect setæ along the entire length. Wings (Plate 1 fig. 21) with a faint brown tinge, the prearcular and costal portions more whitened, stigma long-oval, slightly darker brown than the ground, cord and outer end of cell 1st M. vaguely seamed with pale brown, best indicated by a darkening of the veins, veins brown, more yellowish in the whitened areas. Anterior branch of Rs without trichia; R₁ and all outer branches of M with numerous trichia. Venation: Sc short, Sc₁ ending some distance before origin of Rs, the distance on C about one-half Rs, anterior

branch of Rs directed rather strongly cephalad so cell R₄ at margin is only a little more than one-third as extensive as cell R₄, m-cu at fork of M.

Abdominal tergites or formerly dark brown; sternites and hypopygium yellow. Male hypopygium (Plate 2, fig. 32) with the two dististyles terminal in position, the outer style, *od*, a glan-like darkened blade-shaped more or less like a cleaver, the margins smooth. Inner dististyle *md* at apex extended into a long, slender yellow arm that is tipped with a small black spine and a single very long seta that is longer than the arm itself, the arm at near mid length bears a dense group of short setae. Phallosome, *p*, consisting of curved yellow rods that terminate in a dense brush of setae.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1955, at light (*Sarcot*).

I take much pleasure in naming this distinct species in honor of Mr. Nissor Singh, veteran collector of the Himalayan Butterfly fly Company, who celebrated his eightieth birthday in December, 1935. The fly is allied to species such as *Genomyia* (*L. pophleps*) *sarcot* sp. nov., and *G.* (*L.*) *lateomarginata* Alexander differing very conspicuously from all described forms in the structure of the male hypopygium.

CRYPTOLADIS BEOURAI DILLADIRA sp. nov. Plate 1, fig. 22; Plate 2, fig. 33.

General coloration dark gray; the scutellum yellow, darker medially at base; legs with short setae; wings with a slight grayish tinge, the stigmal region weakly suffused; prearcular and costal regions more whitened; cell 2a A wide; vein 2d A deflected caudad on its distal third; male hypopygium with the dististyles subterminal in position; profoundly blind, the inner arm longer than the outer.

Male.—Length about 3.5 millimeters; wing 3.8.

Female.—Length about 3.6 millimeters; wing 4.

Rostrum and lack, palpi infuscated. Antennae dark throughout, pedicel black, outer flagellar segments elongate. Head uniformly gray.

Prothorax yellowish white. Mesonotal praescutum and scutum almost uniformly dark gray or blackish with a relatively sparse pruinosity; scutellum yellow, darker medially at base; postnotum gray. Pleura dark brownish gray, the dorsopleural region yellow. Halteres pale; the knobs darkened. Legs with the coxae and trochanters testaceous brown, femora obscure yellow, the tips infuscated; tibiae and tarsi brownish black, vestiture of legs

short and appressed, inconspicuous. Wings (Plate 1, fig. 22 with a slight grayish tinge, the stigma region weakly suffused, a vague darkened seam along cord, best indicated by a more intense coloring of the veins traversing prearcular and costal regions more whitened, veins brown, pale in the whitened areas. Costal fringe relatively long and conspicuous. Venation R_2 a little shorter than R_{3+4} , m-cu at near midlength of M_{3+4} , cell 2d A wide, the vein deflected caudad on its distal third.

Abdomen dark brown, the hypopygium brightened. Male hypopygium (Plate 2, fig. 33) with the ninth tergite 9t having each outer lateral angle produced into a slender straight point, median area of tergite slightly produced, the cauda dorsally gently concave. Dististyle d , subterminal in position, long and slender, profoundly L-fid, the outer arm only about one-half as long as the inner but somewhat stouter. Edeagus e , terminating in a very long needlelike point.

Habitat.—China (Hainan Island).

Holotype, male. Ta Hsien, altitude 2000 feet, June 1, 1935 (Gressitt). *Allotopotype*, female. *Paratopotype*, 1 female.

Compared with other similar regional species of *Brachura* that have the wings broad, cell 2d A wide, inconspicuous venary legs, and conspicuously brightened scutellum, the present fly is readily told by the somewhat remarkable male hypopygium, especially the dististyle.

CRYPTOLABIS (BRACHURA) SETOSIPES sp. nov. Plate 1, fig. 23. Plate 2, fig. 34.

Belongs to the *trichopoda* group, general coloration black, scutellum obscure yellow, wings with a dusky tinge, the costal border more whitened, a broad dark seam along cord, cell 2d A narrow, male hypopygium with the lateral angles of the tergite extended caudad into narrow arms, dististyle deeply bilobed, the inner arm slender.

Male. Length, about 3.3 millimeters, wing, 4.

Female.—Length about 3.5 millimeters, wing, 4.

Rostrum testaceous, palpi brown. Antennae apparently 14-segmented, short, dark brown, flagellar segments passing through short cylindrical into long-cylindrical, terminal segment longer than the penultimate, constricted at near midlength, verticils very long and conspicuous. Head light gray, setae and punctures conspicuous.

Prothorax testaceous-gray. Mesonotal praescutum dull black, the humeral region scarcely brightened, scutellum including median area, dull black, scutellum obscure yellow, darker medially at base, parascutella black, mediotergite dark, heavily gray.

pruinose. Pleura black, heavily pruinose, dorsopleural membrane paler. Halteres dusky, the base of stem restrictedly brightened the knobs a little paler. Legs with the femora black, the middle and hind coxae a little paler, trochanters testaceous-yellow, femora brown, tibiae and tarsi brownish black, segments with very long erect setae as in the group, claws (male) very long and slender each with a long, pale erect seta or setoid spine at base. Wings (Plate 1, fig. 22) with a dusky tinge, the entire costal border both before and beyond the stigma whitened, stigma and a broad confluent seam along the cord darker than the ground, basal portions of wing a trifle infuscd, veins dark, paler in the whitened costal portion. Venation Sc ending opposite cord, Sc not far from its tip, anal 2d A narrow.

Abdomen, including hypopygium, brownish black. Male hypopygium (Plate 2, fig. 34) with the tergite 9th produced laterad and caudad into slender glaucous points, median portion of caudal border likewise produced into a low triangular point. What seems to be a part of the eighth sternite is represented by a slender pale structure that terminates in two strong modified setae, suggesting the condition found in *Stenogramma*. Dististyle δ , terminal deeply bifid, the broader outer arm with numerous setigerous punctures, including a denser group at apex, before tip, near inner margin of lobe, with two slender spines, inner arm nearly as long but much slenderer, with setae only at apex. Aedeagus α , broadly depressed except on apical portion.

Habitat.—China (Hainan Island).

Holotype, male, Ta-li-an, altitude 2,000 feet, June 11, 1935 (Gressitt). Allotype female, Liamu, altitude about 1,200 feet, July 31, 1935 (Gressitt). Paratopotype, female.

In its hypopygial structure *Cryptolabis* (*Boreus*) *setosipes* is very different from the other members of the *trichopoda* group described to this date.

CRYPTOLABIS setosipes Gressitt, sp. nov. (Plate 2, fig. 34)

Belongs to the *trichopoda* group, closely allied to *setosipes*, male hypopygium with the outer lateral angles of tergite produced caudad into very long slender blades, the tips subacute, dististyle simple, appearing as an elongate blade, narrowed outwardly to the obtuse tip on outer face at near two-thirds the length with a small peglike spine.

Male.—Length, about 3.3 millimeters; wing, 4.

Female.—Length, about 3.5 millimeters; wing, 4.

Rostrum and palpi dark. Antennae of moderate length, dark throughout, apparently 15-segmented, basal flagellar segments

short ova, the outer segments more elongate with very long conspicuous setae. Head gray.

Mesonotum dull black, the surface very sparsely pruinose; scutellum obscure brownish yellow, the base darkened medially; postnotum more heavily pruinose. Halteres weakly suffused with dusky, especially the central portion of stem. Legs with the coxae brownish testaceous, trochanters obscure yellow, femora brown, tibiae obscure yellow, the tip narrowly darkened, especially the distal portions of posterior legs tawny brown passing into black outwardly, segments of legs with very long conspicuous setae as in the group. Wings with a strong dusky tinge, the costal region more whitish, a darkened cloud along cord, basals slight, infumed, leaving rather clearer areas before and beyond the cord, stigma a little darker, veins dark, somewhat paler in the costal field. Venation. Virtually identical with that of *setosipes*; cell 2d A a trifle narrower.

Abdomen, including hypopygium brownish black. Male hypopygium (Plate 2, fig. 35) with the outer lateral angles of tergite, 9t produced caudad into very long slender blades the tips subacute caudal margin between the horns transverse or very slightly protuberant, not produced into a point as in *setosipes*. Dististyle, *d* simple appearing as an elongate blade that narrows outwardly the tip obtuse, outer face of style at near two-thirds the length with a small peglike spine before apex of style near inner margin with two or three small spinous points as in *setosipes*.

Hab. of—China (Hainan) Island.

Holotype male, Dwa B alt., age about 1,500 feet, July 21, 1935 (Gressitt). Allotopotype female.

Cryptolabis (Bacoura) consona is very similar in its general appearance to *C. (B. setosipes* sp. nov., but is entirely distinct in the structure of the male hypopygium.

STYRINGOMYIA HOLOMELANIA sp. nov. Plate 1, fig. 24. Plate 2, fig. 36.

Entire body black. Halteres and legs black, the tarsal segments slightly paler on basal portions, wings narrow whitish subhyaline, the cord and vein Cu scamed with brown, anterior branch of Rs oblique, male hypopygium with the basistyle bearing two spines, the inner one only half the length of the outer, outer lobe of dististyle with a dense group of spines near base, tenth tergite with median lobe very slender, ninth sternite knobbed at apex.

Male—Length about 5 millimeters, wing, 3.4

Rostrum and palpi black. Antennae black, the outer flagellar segments a trifle paler. Head black.

Thorax entirely black including the coarse but unmodified setae. Halteres black. Legs black, the basal three tarsal segments a very little paler on their proximal portions. Wings (Plate 1 fig. 24) narrow, whitish subhyaline, the cord and vein Cu marked with brown, veins brown. No macrotrichia on veins behind R_1 excepting a complete series of about twenty-two on vein R_2 and an isolated bristle on anterior branch of R_3 ; two or three trichia on outer ends of distal sections of medial veins. Venation: Anterior branch of R_3 oblique, cell 1st M_2 long and narrow, exceeding any of the veins beyond it, m-cu annular at near one-third the length of cell 1st M_2 ; vein 2d A unapertured but strongly curved near outer end.

Abdomen black throughout. Male hypopygium (Plate 2 fig. 6) with the basistyle, b bearing two unequal spines on a short apical lobe: the outer spine about twice the length of the inner, flattened on basal half, inner spine obtuse at apex. Tip of basistyle with an acute blackened spine that is directed mesad. Outer lobe, cd of dististyle relatively stout bearing a dense group or comb of equal black spines on mesal face near base; inner lobe, cd produced into two arms. Tenth tergite, f, with the median lobe very slender appearing as a ligulate structure clothed with abundant erect setae. Ninth sternite, g, bilobed at apex, each lobe obtusely rounded; the median notch acute, the two usual modified setae placed basally on lobes, unusually slender and more or less decussate.

Habitat.—Assam (Khasi Hills).

Holotype, male, Cherrapunji, altitude 4,000 feet, August, 1935, at light (Singer).

Styringomyia holomelana is very different from all described species that have bispinous basistyles on the male hypopygium. The uniformly black coloration of the body, halteres, femora, and tibiae provide characters that separate the fly from all species of the genus hitherto described. It seems to be most nearly allied to *S. obscura* Brulle, yet is amply distinct in the coloration of the body, wings, and legs.

ILLUSTRATIONS

[6. *Klassierung* d. Merkmale d. Individuen des Sexualdimorphismus ist immer distinktion der ersten distinktion u. zentralen u. peripheren + letzten rd. sexual dimorphic.

Page 1

1. *Longicrus haemaphysalis* sp. nov., venation.
2. *Neoravastoma kaianensis* sp. nov., venation.
3. *Phalacroscorus tarsalis* sp. nov., venation.
4. *Limonia (Gresallimomyia) euclyptera* sp. nov., venation.
5. *Limonia (Limonia) caucasicola* sp. nov., venation.
6. *Limonia (Libinia) chinensis* sp. nov., venation.
7. *Antocha (Antocha) Davidula* sp. nov., venation.
8. *Antocha (Antocha) kharicoma* sp. nov., venation.
9. *Pseudolimnophila caucasicola* sp. nov., venation.
10. *Pseudolimnophila ruficostalis* sp. nov., venation.
11. *Huxalema (Eukhuxalema) triphragma* sp. nov., venation.
12. *Huxalema (Eriocera) tuberculata* sp. nov., venation.
13. *Huxalema (Eriocera) kirgiziana* sp. nov., venation.
14. *Eriophlebotomus (Eriophlebotomus) pygmaeolus* sp. nov., venation.
15. *Tricnophila (Mongema) kaianensis* sp. nov., venation.
16. *Gonomyia (Pileotena) kaianensis* sp. nov., venation.
17. *Gonomyia (Eriophlebotomus) conchalis* sp. nov., venation.
18. *Gonomyia (Eriophlebotomus) palaeolus* sp. nov., venation.
19. *Gonomyia (Eriophlebotomus) pulvinifera* sp. nov., venation.
20. *Gonomyia (Eriophlebotomus) alberta* sp. nov., venation.
21. *Gonomyia (Eriophlebotomus) missouriensis* sp. nov., venation.
22. *Cryptolabis (Ravenna) diadema* sp. nov., venation.
23. *Cryptolabis (Ravenna) karelini* sp. nov., venation.
24. *Nyctingomys kharicoma* sp. nov., venation.

PLATE 2

- Fig. 25. *Limonia (Limonium) schimperae* sp. nov. male hypopygium.
26. *Antocha* (*Antocha*, *Antidula* sp. nov. male hypopygium.
27. *Antocha* (*Antocha*, *krasnodarskaja* sp. nov. male hypopygium.
28. *Psendolimnophila conekensis* sp. nov. male hypopygium.
29. *Gonomyia* (*Lixophlebia*) *palustrioides* sp. nov., male hypopygium.
30. *Gonomyia* (*Lixophlebia*) *palustrioides* sp. nov., male hypopygium.
31. *Gonomyia* (*Lixophlebia*) *arctica* sp. nov. male hypopygium.
32. *Gonomyia* (*Lixophlebia*) *halodromae* sp. nov. male hypopygium.
33. *Cryptolabis* (*Uenosa*) *dieliskaya* sp. nov. male hypopygium.
34. *Cryptolabis* (*Uenosa*) *arctica* sp. nov., male hypopygium.
35. *Cryptolabis* (*Uenosa*) *conekensis* sp. nov., male hypopygium.
36. *Syringomyia holomelana* sp. nov., male hypopygium.

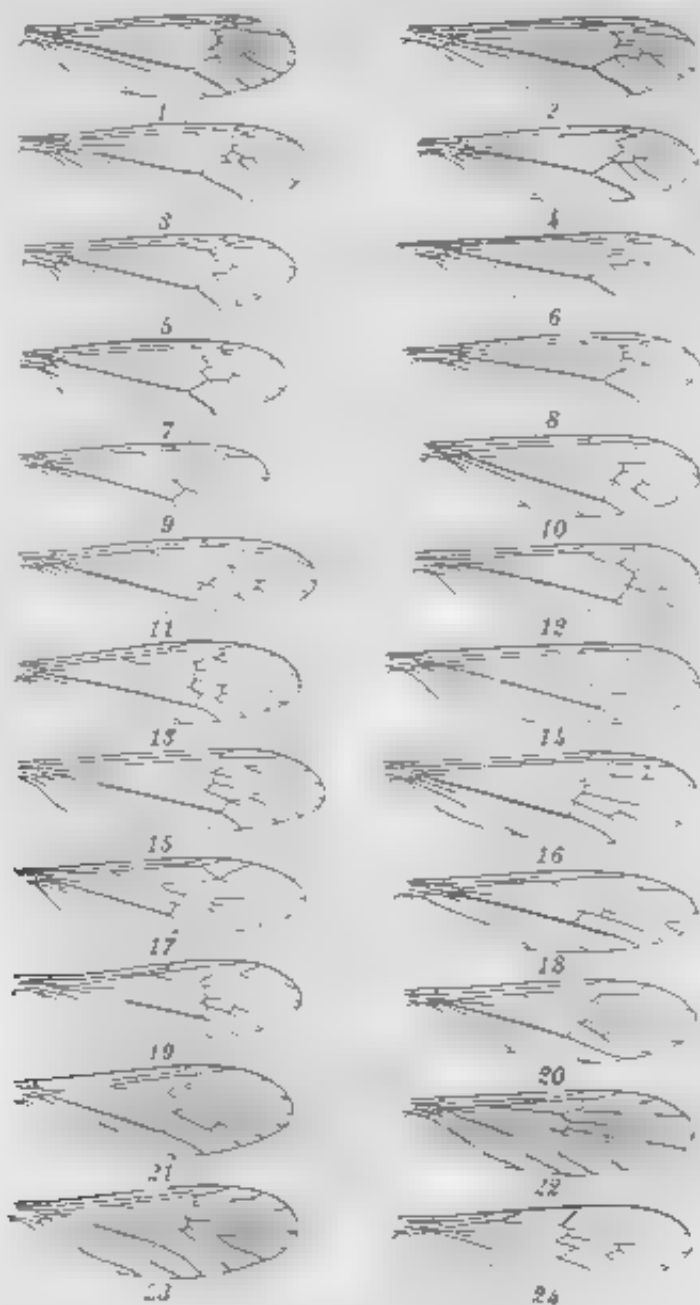
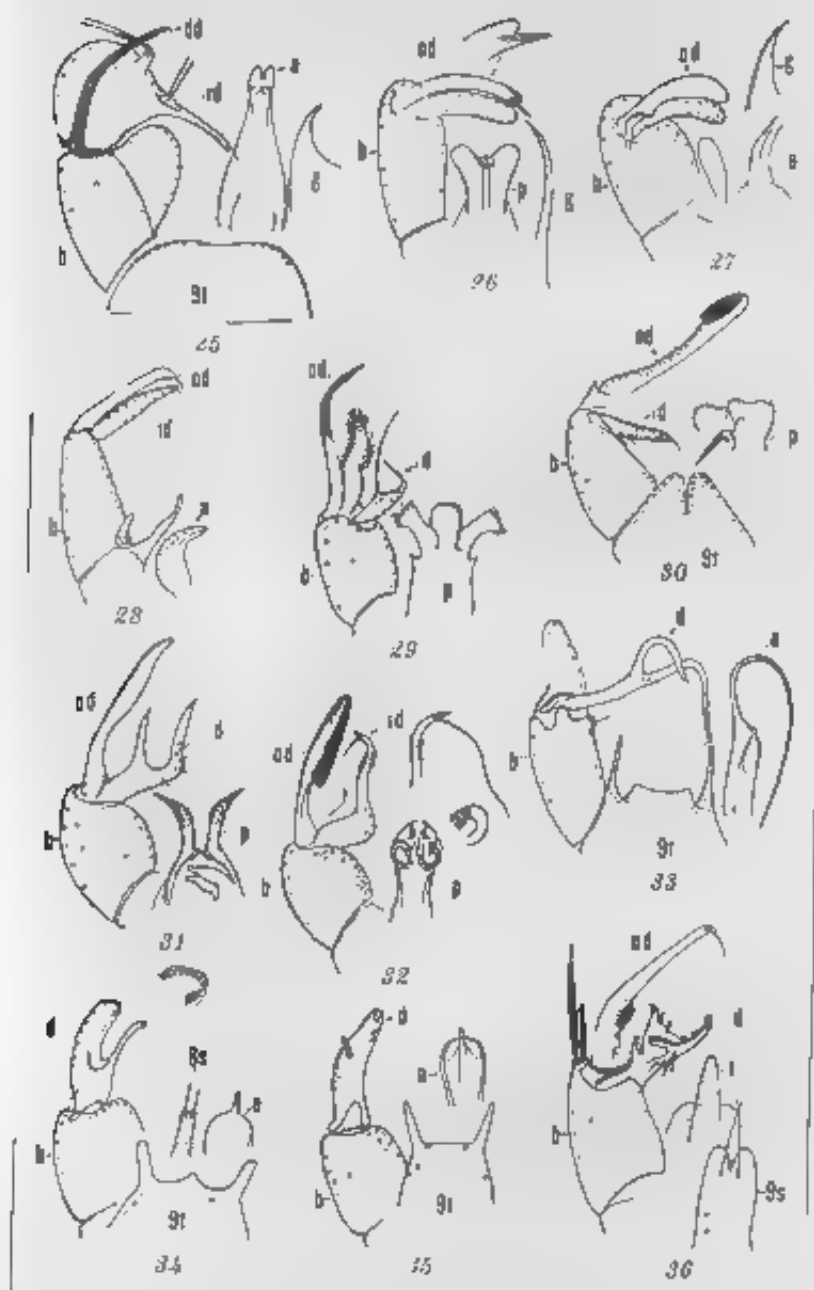


PLATE 1



BOOKS

Acknowledgment of all books received by the Philippine Journal of Science will be made in this column, from which a selection will be made for review.

RECEIVED

JULY 1, 1936

- B. SCHNEE, ABRAHAM and F. JACOBSON. Sex habits, a social factor in well-being. Translated from the German by Eden and Clara Paul. New York: Emerson Books, 1933. xv + 196 pp. illus. Price \$2.50.
- CHICKES, H. M. The physiology of domestic animals. Second revised edition. New York: Constable Publishing Co., 1935. xv + 643 pp. illus., tables, figures. Price, \$6.
- HARROWER, J. R. Three lectures on bacteriology in everyday practice. Glendale, California: The Harrower Laboratory, [c. 1936]. 62 pp. Price \$1.
- HARVEY, WM. CLAUDE, and HARRY HILL. Milk production and control by Wm. Claude Harvey and Harry L. Hill. London: H. K. Lewis & Co., 1936. 556 pp. illus. Price \$4.00.
- HOBSON, Mrs. CORA B. S. Human sterilization to-day: a survey of the present position. London: Watts & Co., 1934. vi + 56 pp. Price, \$0.25.
- International Institute of Agriculture. Rome. The world agricultural situation in 1933-34. (World agriculture: conditions and trends, markets and prices. Agricultural policies and conditions in the chief foreign countries). Economic commentary on the International Yearbook of Agricultural Statistics for 1933-34. Rome, 1935. vi + 502 pp., tables. Price, \$2.50.
- JEFFREYS, HAROLD. Earthquakes and mountains. London: Methuen & Co., 1935. x + 183 pp., front plates, figures. Price, \$2.
- JOHN, H. J. Diabetic manual for patients. 2d ed. St. Louis, Missouri: The C. V. Mosby Co., 1934. 232 pp., front illus., tables, diagrams. Price, \$2.
- LORD, F. T. Lobar pneumonia and serum therapy, with special reference to the Massachusetts pneumonia study [by] Frederick T. Lord and Roderick Jeffries. New York: The Commonwealth Fund, 1936. 97 p. illus., plate diagrams. Price, \$1.
- RITTSBER, W. H. C. Era of capacity for independence. Jerusalem: Syrian orphanage press, 1934. ix + 152 pp. Price, \$2.

REVIEWS

The Bacteriological Handling of Milk. By G. S. Wilson. Medical Research Council, Special Report Series, No. 206. His Majesty's Stationary Office, London, 1935. 392 pp. Price, \$2.

This book gives the results of the author's practical studies on the various technical procedures that have been heretofore used.

in the examination of milk. The usefulness of these procedures is discussed extensively with recommendations on the methods that should be followed.

A description of the modified methylene blue reduction test is given, and according to the author, the test seems to fulfill most of the requirements demanded of the routine grading of raw milk. It gives more information about the milk than does the plate count, the performance of which requires an elaborate procedure by highly skilled workers. According to him the plate count seems to afford no better index of the sanitary conditions of production or of the keeping quality of the milk than the Breed test or the modified methylene blue test. The latter test could be advantageously applied even to certified milk.

Whether the test is suitable for the examination of freshly pasteurized milk or not is doubtful, but there is reason to believe that it could well replace the plate count on bottle samples delivered to the consumer.

Finally it is recommended that whatever tests used no attempt should be made to divide milk into more than three or four classes. From the public-health point of view probably only two divisions need be made on the basis of cleanliness, namely, (a) milk that is suitable and (b) milk that is not suitable for human consumption in the liquid state. T. R. R.

The World Economic Survey, 1934-35. Fourth Year. Economic Intelligence Service. League of Nations, Geneva, Switzerland, 1935. 310 pp. Price \$2.

The book is an extensive review of the world economic and financial developments up to July 1935, being the fourth of an annual series published by the League of Nations. The significant events featured in the international economic commotion during the last few years being presented in a comprehensive and coherent manner, this survey surely is indispensable to anyone who desires to gain a full grasp of the world economic situation. Considerable emphasis is laid on the subjects of currency, production, overseas trade, unemployment, and industrial recovery. Statistical tables, indices and graphs are widely distributed from cover to cover, with the corresponding explanations so given as to be intelligible to the lay reader.

The opening chapter presents a kaleidoscopic view of the chaotic state of economic affairs the world over in 1934. Various steps undergone by the government towards the solution of the problems of finance and trade are mentioned as each country is surveyed. The movement of agricultural and industrial

prices is graphically dramatized by charts and tables. Statistical data of different countries illustrate impressively the law of supply and demand as it affects production, prices, and consumption. With the dawn of industrial recovery is treated the question of unemployment and stability of wages. The rôle played by the National Recovery Act, of all movements, is mentioned in this connection. The recent adjustments in international trade and equilibrium and the expanding basis of credit are equally dealt with comprehensively. The last chapter reviews the more recent constantly changing scenes in the world economic "movies," prominent among them being the "New Deal" program which has become linked with the Roosevelt administration.

The work is well indexed, and on the last pages is appended a chronological list of important world economic events from August, 1934, to July, 1935.—L. M. G.

Milk Production and Control. By W. C. Harvey and Harry Hill. H. K. Lewis & Co. Ltd., London, 1936. 636 pp., illus. Price, \$18.80.

This book is a welcome addition to dairy literature. As the title indicates, special attention is given to the different phases of production and control of milk. Although the book was specially written for present conditions in England, much can be learned from its chapters to help those directly connected with the production and distribution of milk and its supervision in any country.

The first chapter deals with the composition of milk and its food value and rightly serves as an introduction to the entire subject herein treated. The second chapter, *Milk and Disease*, discusses briefly the various diseases transmitted to man in milk. The authors mention several outbreaks to emphasize the importance of milk in its relation to human health. The chapters on the cow and the cow shed discuss briefly the proper care and housing of milk cows. Dairy equipment, actual milk production, and proper distribution are also discussed, with appropriate illustrations, in separate chapters.

A long chapter is devoted to the treatment of milk by heat. Here the different processes of pasteurization of milk and the problems connected with each process are discussed. Sterilization, sterilization, and irradiation of milk are also mentioned in this chapter. Another long chapter, devoted to laboratory and other control, is a good guide for students, health inspectors, and laboratory technicians connected with the inspection of milk.

In the chapters on designated milk and legislative control, the reader can easily follow the development of the dairy industry in England.

Milk Production and Control is not only a good guide or reference book for people concerned with the production and distribution of milk and government officials connected with milk inspection for whom the authors have written this work, but will also serve as a suitable textbook for classrooms.—S. Y. R.

Diabetic Manual for Patients. By H. J. Johns. Second Edition. The C. V. Mosby Company, St. Louis, 1934. 232 pp. Price, \$2.

In this little book the author tries "to present clearly and briefly, what the person with diabetes should know about the disease and its treatment in order that he may, more fully and therefore more successfully cooperate with his physician." With this purpose in view the author explains the underlying laws and principles of the conscious or unconscious violation of which in some way or other produces the disease. He describes how it is acquired and the changes that take place in the body during the illness.

Since food plays an important role in the medical improvement of the patient, a good portion of this book is devoted to diet planned according to the modern trend of giving food more rich in carbohydrates. Thus the food values of different food products are given, the appendices being fully devoted to this purpose. The author also stresses the efficacy and necessity of insulin treatment, and unlike many physicians, encourages its use.

—I. F.

Who Shall Survive, a New Approach to the Problem of Human Interrelations. By J. L. Moreno. Washington, D. C. Nervous and Mental Disease Publishing Co., 1934. 437 pp. diagrs. Price \$4.

Who Shall Survive deals with the study of the emotional relations among individuals who are functioning as a social group, or the cross-currents of emotion as they play back and forth between individuals. The material and illustrations are drawn from institutions and schools. The author develops a technique for a process of classification calculated to bring individuals together who are capable of harmonious interpersonal relationships, and creates a social group which can function at the maximum efficiency and with the minimum of disruptive tendencies and processes. He has rediscovered many homey truths by a different method which permits of their development to a more highly differentiated degree and also their utilization for the benefit of the individual. He differs from the psychoanalytic

approach in a significant way. While the analyst works backward to an explanation for the individual's conduct, he takes the individual's conduct as the starting point and works forward. All his various points of view, methods, and technique are of great significance. This is a good reference book on social problems.

—R. E. G.

The Student's Manual of Microscopic Technique, with Instructions for Photomicrography. By J. C. Tolman. American Photographic Publishing Co., Boston, Mass., 1926. 210 pp., illus. Price, \$2.50.

This is a useful guide for students of anatomy and biology. It contains (a) a good chapter on the microscope, its care, uses, and the physical rationale of its operation, including the polarizing microscope, (b) another excellent chapter on the microscopic objects found in water and the modes of their examination, (c) several chapters on the commoner methods of preparing tissues for microscopic examination, including the principal procedures of sectioning, staining, etc., and their examinations microscopically in the fresh state and as permanent preparations, and (d) a special section on microphotography. Most of the principal topics are illustrated with excellent text figures.

The author has happily combined in one compact and convenient volume the principal methods of microscopic technique usually found in such standard works as Caze's, Lee's, Mallory and Wright's, and others. The book should have general acceptance as an excellent complement to ordinary textbooks of histology and pathology.—A. G.

Mountains and Earthquakes. By Harold Jeffreys. Methuen & Co. Ltd., London, 1925. 282 pp. Price, \$2.

This book gives a comprehensive discussion of the latest developments in the study of the earth from the view points of the physicist, the geologist, and the geodesist. The presentation is well planned, and the language, though precise, is simple. The subject is probably too far advanced for the comprehension of the layman, but it is very interesting to the technical man who has a good working knowledge of mathematics, physics, and geology.—Q. A. A.

The Mental Health Emphasis in Education—A Qualitative Study. By H. C. Patey and C. S. Sterner. The National Committee for Mental Hygiene, Inc., New York. 96 pp.

This treatise has for its working principle the idea that "basically the philosophy of mental hygiene and education are identical and may be stated in terms of complete living or satisfac-

tory functioning of the human organism." In terms of this principle it asserts that "at the present time the relationships of mental hygiene and education are confused by the fact that mental hygienists have given much of their attention to corrective therapy while educationalists have been concerned with fostering normal development without insight gained from observations of exaggerated functioning," and makes an effort to indicate methods of coordinating, articulating, and integrating the other agencies of society; namely, industry, business, law, social service, journalism, art, theology, and medicine, with education, in order for the latter "to realize all of the opportunities that lie within the scope of its own organization and objective." Perhaps too confident and optimistic, the authors claim that "the professional mental hygienist brings to each situation and interpretation intensive experience with the problems of individuals, with the purpose of bringing objectives to a focus in terms of what is most satisfying." A. V. C.

Elementary Microtechnique. By H. Alan Peacock. Edward Arnold & Co. London, 1935. 200 pp. Price, \$1.50.

This is an unassuming little book, which contains much useful information on microtechnic. It is intended primarily for beginners in histology and cytology, although advanced students equally will find the work a good reference book.

The book is introduced with a short summary of the structure of the cell and protoplasm, followed by brief descriptions of the processes of microtechnic. Chapters III and IV cover outlining methods and technic. There is an alphabetical list of special subjects with the various methods to be followed and their preparation in Chapter V; of stains and their uses in Chapter VI, and of formulae and hints in Chapter VII. Three appendices are included, the last being a bibliography.—M. T.

Sex Practice in Marriage. By C. R. S. Evans. Second Edition. Emerson Books, Inc., New York, 1935. 128 pp. Price, \$1.95.

This is a clear and simple exposition of a subject of vital interest to married couples and young people contemplating marriage who are seeking happiness. The book, which is so easy to read that it will but take few hours to finish, will not only help bring about a better understanding between husband and wife but also make for a better appreciation of each other's needs and problems. In serving as a guide in securing a happy mating, this book will help married people in solving their marital problems arising from ignorance of the proper functions

of sex, which will be conducive to harmony in the home, lessen friction, and minimize divorce. Likewise physicians will find the book a great help to their own method of handling related problems.—U. D. M.

Engineer-Custodians Manual. By Thomas J. Brett. American Technical Society, Chicago, 1934. 192 pp. \$2.50.

This is a useful book for building superintendents, engineers, custodians, firemen, electricians, and others interested in the operation and maintenance of public buildings. It embodies valuable information that is usually required for passing competitive civil-service examinations; contains over 500 questions and answers on boilers, combustion engines, heating and ventilating, air-conditioning, pumps, sanitation, plumbing, electrical machinery, and mechanics; over 200 engineering formulas and tables, and general information. The book is fully indexed.

—R. M.

Diesel and other Internal-Combustion Engines. By Howard E. Degler. American Technical Society, Chicago, 1936. 237 pp. Price, \$2.50.

This is practical text on the development, principles of operation, construction, details, and performance of stationary and portable diesel, gas, and gasoline engines.

In Part I the development and application, types, characteristics, efficiency, advantages, thermodynamics, and comparison of internal-combustion engines are set forth. Part II classifies fuels and fuel-air mixtures, gas producers, and liquid fuels and gives fuel-burning characteristics. Part III contains valuable information on automobile and aeroplane gas and gasoline engines. Part IV treats of low-pressure and moderate-pressure oil engines. Part V is devoted to heavy-duty diesel engines of various types. Part VI takes up high-speed diesel engines, their development and application. In Parts VII, VIII, IX, and X is found valuable information on diesel fuel-injection requirements and methods, engine parts, testing and testing methods, and economics of diesel power, respectively.—R. M.

Carpentry. By Gilbert Townsend. American Technical Society, Chicago, 1936. 436 pp. Price, \$2.

This book is a practical treatise on simple building construction, including framing, roof construction, general carpentry work, exterior and interior finish of buildings, building forms, and working drawings.

The book is adapted for use as a text in vocational, trade, high, and technical schools. It is an excellent text for home

study and reference for carpenters, apprentices, home owners, and anyone interested in building construction work.—R. M.

Air Conditioning and Engineering. By Engineering Staff of American Blower Corporation and Canadian Sirocco Co., Ltd. American Blower Corporation, Detroit, 1935. 691 pp. Price, \$5.

This is a treatise on the technic of conditioning and mechanical movement of air for the health and comfort of human beings and the efficiency of production in industry. It is a ready reference containing valuable data on air conditioning and engineering, including fundamental principles, laws, tables, sample calculations, and information relating to dimensions and capacities. In the apparatus and equipment section are found dimension and capacity tables and types of equipment used in actual practice. It is an excellent book for air-conditioning engineers.

—R. M.

A Guide to Sexing Chicks. By Charles S. Gibbs. Orange Judd Publishing Co., Inc., New York, 1935. 63 pp. Price, \$1.25.

The author is a research professor of veterinary science at the Massachusetts State College at Amherst. In his *Guide to Sexing Chicks* he describes the art which was first brought to light by Kiyoshi Masui and Juro Hashimoto of Tokyo Imperial University, and later put into practical application by Kojima and Sakagiyma. He mentions two schools of chick sexing, one depending upon the presence or absence of processes in the vent, and the other on the wrinkles of the mucous membrane of the cloaca.

Sexing chicks, as an art, requires skill, clear vision, rapid eye accommodation and ability to withstand bright light, steady hands, and nimble fingers. To the novice patient practice and mastery of its technic are necessary to attain a satisfactory degree of proficiency. The detailed description of the steps to be undertaken given in this book will be of practical value to him and other beginners.

The author suggests that sexing be done in bright day light or with the use of a 200-watt electric bulb, either blue or with frosted tip. The best time to sex is twelve hours after hatching or as soon as the chick has dried. A large process in the vent identifies a cockerel, and no process or a small one, a female. In actual identification a group of 5 per cent is confusing and may turn out one way or the other.—C. X. B.

The Medical Cookery Book. By Dorothy Sewart. J. Wright and Sons, Ltd., London, 1925. 136 pp. Price, \$1.25.

In the convalescent stage of many diseases in which drugs usually play an insignificant part, nourishment is more vitally important to the patient, since a suitable diet is more conducive to recovery. At this stage the consideration of proper foods becomes the concern of those whose responsibility it is to prescribe diet. The 300 recipes compiled in this book for making soup, salads, and other ideal foods for convalescents will provide the solutions to most of the problems concerning the right foods to give. The recipes have been thoroughly tested and are simple and economical. The book also contains much information on how the foods should be served, which suggestions increase its practical value.—A. J. H.

International Trade; Principles and Practices. By Paul V. Horn. Prentice-Hall, Inc., New York, 1925. 723 pp. Price, \$5.

A comprehensive treatise on its subject, this book not only deals with the principles and practices of foreign trade, but also treats of its historical background and its legal aspects. Intended primarily as a textbook for use in colleges and universities, the book will be found useful by students and by those who are actually engaged in international trade. A lot of valuable information is given which the latter, especially, could use to advantage to broaden their knowledge of the aspects of overseas trade as a profession. The subject is discussed as a business calling, and also as an instrument of governments in their international relations with one another.

Chapters 5 and 6 deal with a graphical survey of international trade. Chapters 10 and 11 give a history of tariffs in general and of United States tariff in particular, and trace the evolution of international commercial policies from antiquity to the present. Thoroughly discussed in Chapters 17 and 18 are the subjects of foreign investments, foreign exchange, and the financing of foreign trade. The practical *modus operandi* of foreign business trade is likewise fully treated, just as the technique of foreign-trade promotion and advertising and the collection of foreign credits are ably presented.

Adding much to the usefulness of the book are the review questions, problems, and suggested references at the end of each chapter.

A typographical error in the chart on page 154 (Organization of the United States Customs) is evident, the territories under

the jurisdiction of the Secretaries of War and Navy having been interchanged.—A. de C.

Lancashire Sea-Fisheries Laboratory. James Johnstone Memorial Volume. University Press of Liverpool, 1934. 342 pp. Price, 21s.

The latest tendency in the cultured world in the way of honoring a scholar is the publication of a memorial volume giving evidences of the world's appreciation of his work. For this purpose the present volume was prepared to commemorate the death of James Johnstone and his retirement from the chair of Oceanography at Liverpool in 1935. It is a symposium on various matters dealing with the sea, including its physical and biological phenomena. It includes original investigations on varied oceanographic topics, written by men identified with various well-known schools of thought, both of Europe and America. The articles are independent from one another, and the only coördination among them is that they reflect the world to which Johnstone dedicated himself. In each article much useful information will be found by the oceanographer, the embryologist, the geologist, the ecologist, the parasitologist, and the physical chemist.—H. A. R.

Researches on Vitamins, 1900-1911. By Prof. Dr. G. Grijns. J. Noorduyt en Zoon N. V., Gorinchem, 1935. 254 pp.

This book was prepared to give evidence of the admiration and gratitude which the world owes Dr. G. Grijns for his valuable contributions to the science of vitamins. It is a compilation of his early works covering his investigations on polyn neuritis gallinarum, with which is included his thesis on "the physiology of the nervous opticus," translated into German, and which was published while he was still a student at the University of Utrecht.

Doctor Grijns is largely to be remembered for his classical researches on beriberi. With his predecessor Eijkman, a fellow Dutchman, he is acknowledged as one of the founders of vitamin science. Considering the consequences of his investigation and the benefits which mankind reaped from them, Grijns deserves more of the world's gratitude than can be expressed by the preparation of this memorial volume.

The book, however, is more than a commemorative volume. In making the classical studies of the author accessible in English translation, the book commends itself to a large circle of readers, especially those who are making a historical study of vitamin science.—A. J. H.